Anne Arundel County, Maryland

Anne Arundel County Fire Department

Fire Services Deployment Study

November 2008

Fire Services Deployment Study

Anne Arundel County, Maryland

Submitted to:

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November 2008

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EXECUTIVE SUMMARY

Anne Arundel County selected TriData, a division of System Planning Corporation located in Arlington, VA to conduct a resource deployment study of its fire department

The Anne Arundel County Fire Department (AACoFD) protects 416 square miles with over 510,000 residents Apparatus are deployed to 30 stations with one new station (8) expected to open in early 2009. The FY08 authorized staff level of 834 personnel includes 34 civilians and 7 contract employees.

Key findings are below; the report discusses the current state of the department and rationale for recommendations in detail.

Population Growth and Demand

- The demand for emergency services has grown rapidly since 1992; incidents more than doubled from 20,000 to 47,000 incidents
- Another 10,000 incidents are likely to be added over the next ten years
- Rescue calls, which include emergency medical incidents, account for about 45,000 incidents per year
- Actual fires account for a small percentage of the total incidents

Glen Burnie has the highest demand, largely because it has almost twice the population of any other planning area. However, the South County planning area leads in all of the fire risk categories such as per capita dollar loss and fire fatalities.

Station Location and Response Times

Fire calls are dispatched faster than EMS calls by almost 30 seconds. EMS calls require more information before dispatching. From 2003-2007, the 90th percentile dispatch time was 2 minutes, 21 seconds.

Call processing times are consistent throughout the day even during times when demand is highest, which is good.

During the same period, travel times averaged 3 minutes 38 seconds and had a 90th percentile of 6 minutes 22 seconds. National standards call for a 4-minute travel time, so this is good performance on average. However, there are problem areas in the county. Travel times are higher in the southern, more rural areas. Adding the new station in Annapolis Neck (Station 8) will improve response times in one area that is presently high.

Analysis shows that the county can improve response times by relocating nine of its existing stations. One new station is also recommended for South County; however, it is not a high priority yet. Following are the recommended station location changes and one new station. Priorities are in parentheses:

- Broadneck – Relocate Station 17 (Arnold) near the intersection of Jones Station Road and Church Road (*Low Priority*)
- Crownsville – Relocate Station 6 (Herald Harbor) to the vicinity of Generals Highway and Herald Harbor Road (*High Priority*)
- Deale/ Shadyside – Relocate Station 1 (Galesville) to the vicinity of Crandell Road and Muddy Creek Road (*Very High Priority*)
- Edgewater/ Mayo – Relocate Station 2 (Woodland Beach) to the vicinity of Muddy Creek Road and Central Avenue/Route 214(*High Priority*)
- Glen Burnie – Close Station 26 (South Glen Burnie) and build a new station in the vicinity of Veteran's Highway and Old Mill Road (*Low Priority*)
- Glen Burnie – Construct a new station in the vicinity of Ritchie Highway and East Ordnance Road, Brooklyn Park (*Low Priority*)
- Lake Shore – Close Station 20 (Lake Shore) and build a new station in the vicinity of Forest Glen Drive and Mountain Road (*Very High Priority*)
- Lake Shore – Close Station 10 (Jacobsville) and build a new station in the vicinity of Fort Smallwood Road and Water Oak Point Road (*Low Priority*)
- Odenton – Close Station 28 (Odenton) and build a new station in the vicinity of Annapolis Road/Route 175 and Telegraph Road, or just slightly south near Piney Orchard Parkway (*Moderate Priority*)
- South County – Construct a new station in the vicinity of Davidsonville Road and Central Avenue (*Moderate Priority*)

Several stations are volunteer-owned facilities. If the county relocates some stations, volunteers could possibly remain at their current facility. However, the county should relocate its career staff to the new stations to improve coverage.

Fire Operations – AACoFD is a combination department with volunteers augmenting career staff. Going forward, the county needs to provide more support to its volunteers if it wants to keep them, and not have to hire more career staff.

Since its inception the fire department has been progressive; however, staffing levels have not kept pace with the demand for services, especially EMS. The policy that requires cross-staffing of fire and EMS units is a contributor to the long response times in some areas (as well as geography). The fire department uses a "handle first emergency" concept where crews respond to the first reported call—emergency or non-emergency. This policy works well when call volumes are low, but as the county population and demand has grown it is no longer satisfactory.

Of the first-line fire and EMS fleet, 58 vehicles are county-owned and 31 are owned by the independent volunteer companies. That volunteers purchase many of the vehicles is to the county's financial advantage.

Fire units often are responding with two and sometimes even one person, which is inadequate. Although four-person staffing is not required for every fire suppression unit, four-person crews are recommended for the county's ladder/ tower units.

Better use of the county's available resources can be achieved and response times improved if staffing levels were better and the county's EMS units were staffed independent of fire units. With improved unit staffing the fire department could lower the number of units it sends to calls to achieve the required on-scene staffing. Sending fewer units would then improve response times, especially in rural areas where stations are farther apart. It would reduce risk to firefighters and citizens (fewer emergency vehicles speeding to incidents) and would help to lower response times in populated areas where demand is high (more vehicles left to respond).

Key recommendations for unit staffing and deployment:

- Establish the three-person crew as the minimum for engines and four-person crews in the more rural areas where response times for second and third-due units are longer.
- Maintain the current number of squads but implement a rotation plan such that volunteers staff two squads 24/7
- Maintain the present alignment of three battalion and one division chief for the present
- Increase staffing at stations with two fire suppression units such that each unit always responds with an officer.
- Adopt a county-wide policy for scheduling volunteers and consider an incentive program for volunteers who schedule their participation

To meet the above recommendations will require:

- Adding an officer to Stations 7, 12, and 13
- Increased staffing to four at Stations 1, 6, 9, 23, 27, and 41
- Increased staffing to four for Quints 4, 30, Trucks 21, 26, 31, and 40
- Increased staffing at Station 5 to four for a quint

Emergency Medical Services

EMS calls comprise 70 percent of all calls handled by the fire department. Greater demand for EMS and fewer EMT-Ps is stressing the department's ability to provide care within nationally accepted response times.

One issue is whether two Emergency Medical Technician-Paramedics (EMT-P) are needed on every unit. Debates continue but there is little scientific evidence, to support two EMT-Ps on each unit. A more efficient approach without sacrificing much medical quality is to staff medical units with one paramedic and one EMT-Basic, dispersing other paramedics to engine and truck companies. Strategically placed paramedic engine and truck companies, along with the EMS supervisors would still provide a second EMT-P when needed.

Of the county's 16 small planning areas, 10 have medical response times which are too long when compared to national standards. Within 10 years, EMS calls are projected to increase from 57,000 to 66,000 calls per year, so the situation will worsen if nothing is done. To improve service, three basic life support units are needed by 2011.

To offset costs for additional resources, revenue can be generated by charging for medical calls. Using the federal classification system for EMS reimbursements, and a conservative collection rate of 50 percent, EMS revenue in 2007 would have been approximately $6.9M.

Fire Station Functionality

The volunteer-owned stations are becoming outdated; 7 of the 11 stations are over 60-years old. Only one volunteer station has been constructed since 1975.

The county's prototype fire station design is 11,000 square feet with drive-through bays. However, smaller, less expensive fire stations could be used in the future. A residential-style modular fire station could be constructed for much less than the $2.8 for the station in Annapolis Neck.

We inspected every county fire station to evaluate their capacity to meet the county's current and future needs in light of demand. The following were judged to be the highest priorities for capital improvements:

- Relocating Station 1 (Deal/ Shady Side) near Galesville Road and Muddy Creek Road
- Relocating Station 20 (Lake Shore) near Forrest Glen Drive and Mountain Road
- Relocating Station 6 (Crownsville) near Generals Highway and Herald Harbor Road
- Relocating Station 2 (Edgewater/ Mayo) near Route 214 and Muddy Creek Road

Using a less expensive residential-style construction, the estimated total cost for these projects is $4.0M.

Additional Staffing

Additional staffing is needed to allow medic units to be independently staffed. The highest priority is 46 personal ($3.14M) for seven stations where medical units should be independently staffed from the engine.

The total package to increase career staffing on engines and quints plus allow independently staffed EMS units county-wide is approximately $7.7M total. If the county collected EMS fees, most of the cost of the extra personnel would be covered.

A Final Comment

A previous resource deployment study recommended many new stations, all of them career units staffed by four personnel. Our findings are different. Adding many new stations would not correct the problem of long response times if the fire department continues cross-staffing most fire and EMS units and handle the first call, whether fire or EMS.

Cross-staffing and HFE was appropriate when call demand was much lower, but it is not working now. Going forward the county should increase staffing such that eventually all of the county's EMS units are independently staffed from fire units.

The county should also strive to get more participation from the over 500 certified volunteers on the roster, such as by increasing incentives for volunteers who agree to be scheduled for a certain number of hours. Having a schedule to maintain a minimum crew size has been successful at the Odenton Volunteer Fire Department and could work other places too.

ACKNOWLEDGEMENTS

We wish to thank the members of the County's Project Management Team (PMT), Anne Arundel County Fire Department (AACoFD) and the many County departments that provided valuable insight for this study. They not only provided information and welcomed our visits to their areas but also interacted helpfully with us throughout the study.

Fire Chief David Stokes and newly appointed Fire Chief Robert Ray along with many other career and volunteer officers, firefighters, EMS personnel and county staff members were extremely cooperative, gracious, and forthcoming during the project. They provided data, facilitated tours of the county's fire stations, and they discussed openly the deployment opportunities and challenges facing the organization.

We particularly want to acknowledge the efforts of Deputy Chief Ron Strobel, who acted as the primary point of contact for the fire department. Chief Strobel effectively coordinated the various meetings and data collection needs of the project, and he put us in contact with the right individuals when we needed more information. Without his support this project would not have been possible.

We wish to thank the following for their help on this project:

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Diane Croghan	BRAC Assistant
Henry Farrell	Budget Administrator

Although we received valuable input from a variety of sources, the findings and recommendations contained in this report are entirely those of the TriData project team. Although each member had specific project responsibilities, the team interacted to get alternative views on a variety of topics. Principal members of the team and their areas of responsibility are shown below.

TriData Staff

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FOREWORD

TriData, a division of System Planning Corporation (SPC), is based in Arlington, VA. SPC is a 200-employee defense and national security contractor specializing in high-level systems engineering and national security.

Over the past 26 years, TriData has completed over 45 studies for metro-size communities and 160 studies for communities of all sizes. In addition to the local government studies, TriData is also noted for their research on behalf of the United States Fire Administration (USFA) and the Department of Homeland Security (DHS). TriData also conducts international research on emergency response topics and has conducted extensive research on effective prevention strategies in Europe and Asia.

I. INTRODUCTION

Anne Arundel County, MD, solicited the assistance of an outside firm to conduct a resource deployment study of its fire department. The study included a comprehensive analysis of response times and service-level demands throughout the county. TriData, a division of System Planning Corporation located in Arlington, VA was selected by competitive bid to conduct this study. Over the past 26 years, TriData has conducted similar studies and research on fire and EMS-related issues for over 150 communities.

Scope of Work

The scope of work for this project was divided into two tasks. Elements of work in Task 1 and Task 2 included:

Task 1

- Review and report on the current level of service
- Analyze the location of the county's 30 existing fire stations, including their staffing and apparatus
- Evaluate the daily operations of the County Fire Department
- Evaluate the condition of the current fire stations
- Review the current levels of service delivered to various geographical areas of the county
- Conduct a peer review of similar departments

Task 2

- Recommend and prioritize any proposed changes and modifications to the current levels of service, which may include:
  - relocation or combination of existing stations
  - remodel/ rebuild existing stations
  - redeployment of personnel, apparatus, or specialized units
  - additional personnel, stations, apparatus, or specialized units
- Provide four levels of delivery improvements related to the fire department's existing budget:
  - Existing level of funding
  - Five percent budget increase
  - Ten percent budget increase
  - Optimal performance with no budget increase restrictions

The scope of work also required us to provide the county with the software used for the data and GIS analysis portion of the work and to train selected individuals within the fire department on its use.

TriData project team members also conducted numerous meetings with the county's project management team (PMT), and made presentations to the County Executive and County Council. At the project's conclusion a draft report was provided to the PMT. The PMT provided input on the report and a final report was delivered.

Study Process

Effective studies require input from all major stakeholders. Consequently, extensive interviews were conducted with key county officials and career and volunteer personnel, and information was gathered through site visits, conference calls, and e-mail exchanges. The county also provided an extensive amount of incident data that was analyzed by TriData fire analysts.

The study began in February 2008 with a kickoff conference call with the county's PMT. During the call we reviewed the scope of work, the goals of the study, and the specific information needed to ensure accurate analysis. Coordination of the first visit and the first round of meetings were also discussed.

Over the next several months, the project team gathered additional information and conducted additional interviews. Data and background information, including call statistics, budget information, personnel figures, staffing reports, apparatus and maintenance reports, and CAD and GIS data were collected. Throughout the project, team members reviewed information collected from interviews and analyzed data. The project team met regularly to compare information, share ideas, and solicit input on major findings and recommendations. While individual project team members were assigned specific responsibilities, the end product is a collaborative effort.

In May 2008, TriData staff provided a briefing to the PMT on the major findings and recommendations. We also met with the fire chief and members of his staff to discuss the findings and proposed deployment alternatives. Also discussed were the draft review process and timing of the draft and final reports. The draft report was delivered in July with the final report delivered in November 2008.

Overview of Fire/Rescue Services

Prior to the establishment of the Anne Arundel County Fire Department, fire protection in Anne Arundel County was provided by individual community volunteer fire departments. In 1924, the Maryland State Legislature authorized the Anne Arundel County Commissioners to appoint a paid "chauffer and caretaker" for the volunteer stations at Earleigh Heights, Glen Burnie, and Eastport. "Chauffeurs" became county employees in 1932 and were later called "Enginemen."

In 1963 the County Commissioners established the position of Fire Marshal to oversee fire prevention for the County. In 1965, charter home-rule was adopted and the present-day Anne Arundel County Fire Department was initiated one-year later. Harry W. Klasmeier was appointed the county's first Fire Chief. Chief Klasmeier, a well-respected and forward-looking leader, served until 1983. To his credit, Chief Klasmeier was instrumental in bringing together the independent volunteer fire companies to form a central county fire department. In 1966, the county also created a central alarm center, fire prevention bureau and training academy.[1]

At the time of this study, the fire department's authorized staff level is 834 personnel. Of these 34 are civilian personnel and 7 are contract. The fire departments current budget is $93.3M, of which $79.4M is for personnel (83.9%). The only revenue generated by the fire department is for inspections; however, legislation to charge for medical calls was adopted by the County Council during the course of this project.

Background of the County

Anne Arundel County is a diverse community covering 416 square miles. Situated on the western shores of the Chesapeake Bay, the county has 533 miles of shoreline to protect and the county's history is directly tied to the Bay. Agriculture also played a major role in the county's growth and development patterns. The county's many peninsulas and population density variations make locating fire stations and emergency response resources challenging from an efficiency standpoint.

More recently, the county's proximity to Baltimore and Washington, D.C. has led to the county becoming more suburban. It also now has its own base of high quality jobs many of them in government and research-related fields. This trend is continuing with the planned expansion of Fort Meade beginning in 2009–2010.

[1] http://www.aacounty.org/Fire/

According to the U.S. 2000 Census, the population of Anne Arundel was 489,658. The latest estimates place the county's 2007 population at 512,154.[2] The chapter on population growth, risk, and demand describes how this population growth increases call volume for fire and rescue personnel. Population growth trends are also important in determining the most appropriate resource deployment model for the County. As of the last census, residents of Anne Arundel had a per capita income almost 8 percent above the state average.[3]

Organization of the Report

The report is organized as follows:

Chapter II, Population Growth, Demand, and Risk Analysis – This chapter includes important baseline information on the existing and projected demands for service in the county. As such it discusses the pressures on the fire/rescue system, including population growth, demand for services, and unit workloads. These factors are important in evaluating future viability of the system and identifying resource needs.

Chapter III, Station Location and Response Time Analysis – This chapter discusses the deployment of fire stations and emergency response apparatus in Anne Arundel County. A geographic information systems (GIS) based analysis of station locations and resource deployment is presented with recommendations to modify station configurations to provide more effective coverage. The chapter also contains an in-depth review of response times.

Chapter IV, Fire Operations – This chapter discusses the largest division of the fire department, operations. It includes recommendations to improve staffing at various stations and the redeployment of units. It concludes with a comparative analysis of fire departments similar to Anne Arundel.

Chapter V, Emergency Medical Services – This chapter contains the analysis of the medical response capabilities of the fire department, which includes an analysis of capabilities and EMS response times by planning area. It also contains the review of EMS fees and revenue.

Chapter VI, Fire Station Functionality Assessment – This section is the assessment of fire station facilities and our review of a previous study of fire stations conducted in 2006. The findings were used in conjunction with the GIS station location and response time analysis to determine the location for new facilities. The chapter concludes with a discussion of a smaller and less expensive station model the county should consider.

[2] Maryland Department of Planning, Planning Data Services
[3] U.S. Census, 2000

Chapter VII, Summary of Recommendations and Their Cost – The section provides baseline information on personnel costs by planning area and discusses the cost estimates for new facilities. It also includes a summary of the personnel and station location changes recommended by this study. The chapter concludes with the cost estimate and priority of each recommendation.

Appendices – Included here are additional graphs and call-density maps for each small planning area and other supporting information.

II. POPULATION GROWTH, DEMAND, AND RISK ANALYSIS

This chapter analyzes three major components that serve as a basis for recommendations made later in the report: population growth, demand projections, and risk analysis. Based on information and data gathered from Anne Arundel County Fire Department (AACoFD), this chapter attempts to identify the underlying need for emergency services in the County. The next chapter considers emergency services deployment. This chapter provides the setup by looking at the location and level of emergency services demand throughout the county, the factors that are driving this demand, and the result of this demand (fire loss, deaths, and multiple alarm fires).

The chapter is divided broadly into a countywide analysis followed by an analysis by small planning areas. The first part provides a macro evaluation of emergency services demand in Anne Arundel County. First, we look at factors such as population that affect emergency services demand in the county. Then we review the results of an emergency services demand analysis that was conducted on 15 years of incident data provided by the County. This analysis includes information about the composition of emergency incident types and shows the trend of each of the different incident types. Finally, we review projected emergency demand and workload (of individual AACoFD units) through 2012 that is based off of statistical trend modeling.

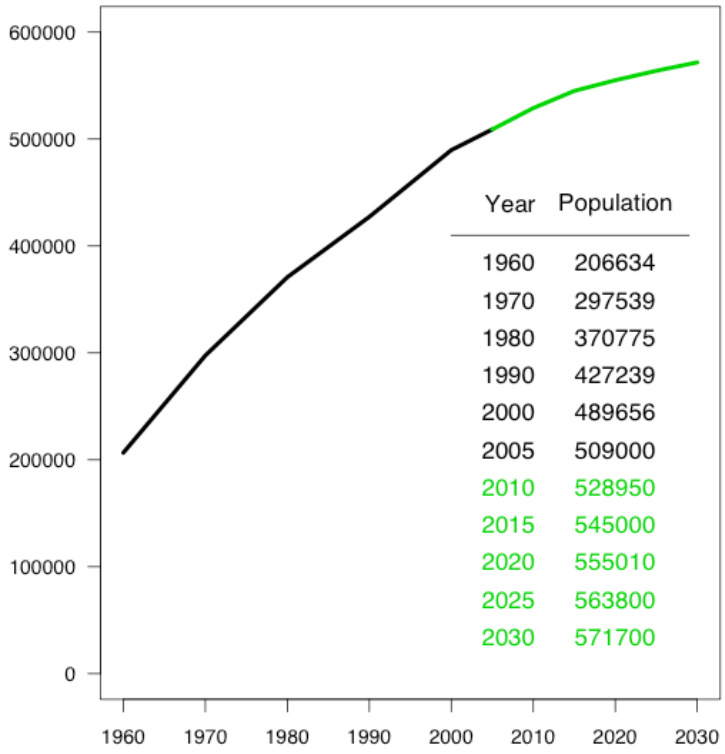
Analyzing current and projected demand county-wide is a good tool for understanding general trends. However, it is difficult to make deployment decisions from 'generalized' information. For this reason, we dig deeper and provide analysis and comparisons for each of the small planning areas. The section starts by providing descriptions of each of the small planning areas (based on information from the Anne Arundel County Planning Department). After that, we review population and population densities for each of the small planning areas. Finally, we look at several important inter-planning area comparisons including total incidents, the financial cost of fires, fire deaths, and the number of multiple alarm fires. Understanding this information is very important for making the deployment decisions discussed in the next chapter.

Factors that Affect Emergency Services Demand

The county's ability to provide adequate fire and emergency protection must be viewed in light of demand. Demand in turn is estimated based on historical and projected population increases and the effect that the United States Defense Department's Base Realignment and Closure process—mainly at Fort Meade—will have on the county and emergency services.

Population – Anne Arundel County's steady population growth is well documented. Overall, population has increased consistently and more than doubled since 1960, when the county had approximately 207,000 residents.[4] The 2005 population was estimated at over 509,000.5 Figure 1 shows Anne Arundel County's population from 1960 to present and population projections through 2030 prepared by the Maryland department of planning.

Figure 1: Actual and Projected Population, 1960–2030



Base Realignment Commission – Base Realignment and Closure (or BRAC) is a process of the United States Department of Defense (DoD) and Congress to close excess military installations and realign the total asset inventory in order to save money on operations and maintenance. More than 350 installations have been closed in four BRAC rounds: 1989, 1991, 1993, and 1995. The most recent round of BRAC completed in the fall of 2005 and with the commission's recommendations became law in November of 2005.[6] Closing some bases often increases personnel at others.

Because a military base can bring millions of dollars in federal money to its surrounding area each year, the BRAC process has a significant effect on all the communities involved. Not

[4] Maryland Population of Counties by Decennial Census: 1900 to 1990. United States Census Bureau (95-03-27).
[5] Population and Population Centers by State: 2000. United States Census Bureau.
[6] http://en.wikipedia.org/wiki/Base_Realignment_and_Closing_Commission

only is there a financial aspect to the changes, but also large population shifts as military personnel relocate. Fort Meade, located adjacent to Odenton in the Northwest part of Anne Arundel County is scheduled to receive additional activities and personnel as designated through the 2005 BRAC process. The following groups are moving to Fort Meade:

- Defense Information Systems Agency (DISA),
- Adjudication and Office of Hearing and Appeals Offices, and
- Several DoD media activities.

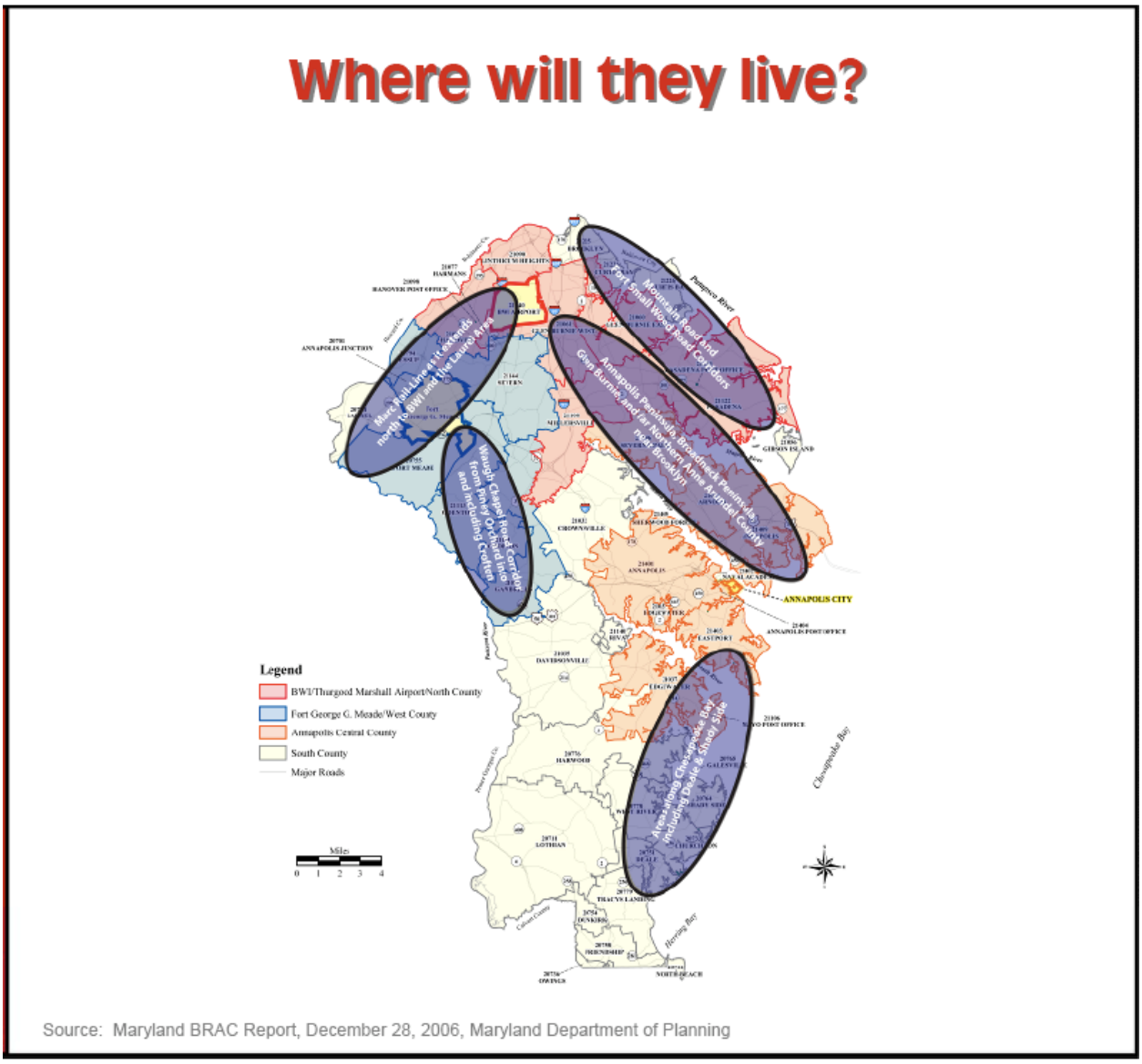
It is estimated that these BRAC relocations will bring 22,000 jobs to the Fort Meade area (including both military positions and local businesses to support increased military personnel). Combined with an estimated 15,000 new jobs unrelated to BRAC, Anne Arundel County expects to add 37,000 more workers to the county in the next ten years. These numbers imply that the county's growth rate over the next decade will remain similar to that of previous years. In just the last five years, Anne Arundel County added 25,000 jobs.

This rapid growth rate is likely to have a large impact on emergency services demand. Although Fort Meade has its own federal firefighters, most of the newly relocated personnel will not be living on base. Also, not all of the projected county growth is related to BRAC. Although newer construction associated with this growth might not pose a significantly larger fire risk because of improved fire resistant construction techniques and sprinklered commercial buildings, the increased population will definitely bring an increase demand for emergency medical services. Therefore, it is important to determine where most of the expected population increases will be within the county.

Many of the jobs moving to the base (particularly the DISA jobs) pay over $100,000. Many of the relocated personnel will be trying to move into more affluent communities in Anne Arundel and surrounding counties. As a result of the BRAC, the Maryland Department of planning expects 10,900 new households around Fort Meade of which 4,500 households are expected to be located in Anne Arundel County. A study was conducted by the Maryland Department of Planning to determine where most of these new households will likely be located.7 Figure 2 shows the new household areas. Each of the ovals shows areas to which population and households will be added.

[7] Maryland BRAC Report. December 28, 2006. Maryland Department of Planning

Figure 2: BRAC Housing Map



Increasing population is nothing new for Anne Arundel County. To best prepare emergency services for this growth, we need only to look at the affect this growth has had on demand for emergency services over the last decades.

Emergency Services Demand Analysis

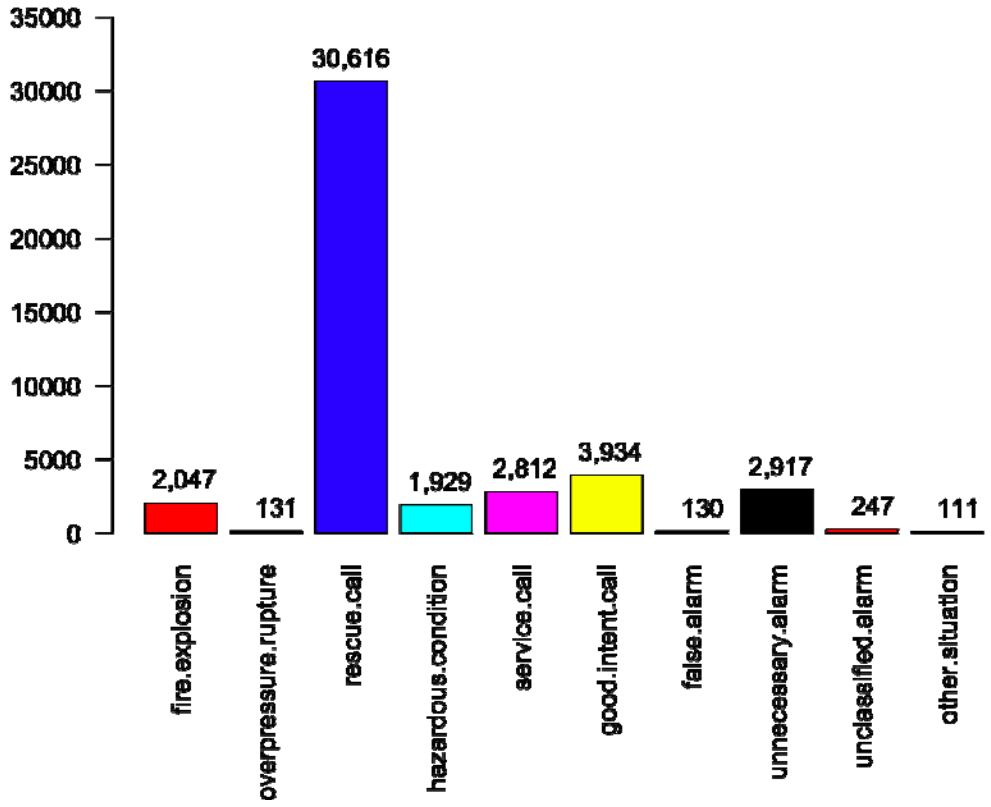
This section takes the information on past history and estimates the number of fire and rescue incidents over the next 15 years, based on trends and what is expected in population and industrial growth. Needless to say, 15 years is a long time, and the further one peers into the future, the less certainty there is with regard to the estimated demand for service. Various local, state, and federal factors may affect the demand for service and the nature of the fire service.

Nevertheless, it is interesting to develop scenarios for the future as an aid in planning for service delivery.

Data Used for the Analysis – Anne Arundel County Fire Department provided 15 years of data (from 1992 through 2007) using the United States Fire Administration's National Fire Incident Reporting System (NFIRS) data format. The data contains detailed information about each incident to which the fire department responded.

Composition of Emergency Incidents – Although there are many ways to categorize emergency incidents, we used the National Fire Incident Reporting System groups used by the United States Fire Administration. Figure 3 shows the results for the latest three-year average. Each incident can result in multiple responses or runs, the numbers here reflect the number of incidents, not the total number of runs they generate. The incident types tell you want kinds of emergencies the citizens have.

Figure 3: Incident Types, 2005–2007



Rescue calls, which include emergency medical incidents, account for the vast majority of AACoFD incidents. On average, the fire department responds to 45,000 incidents per year, of which roughly 70 percent are emergency medical (rescue) incidents. Rescue incidents trended

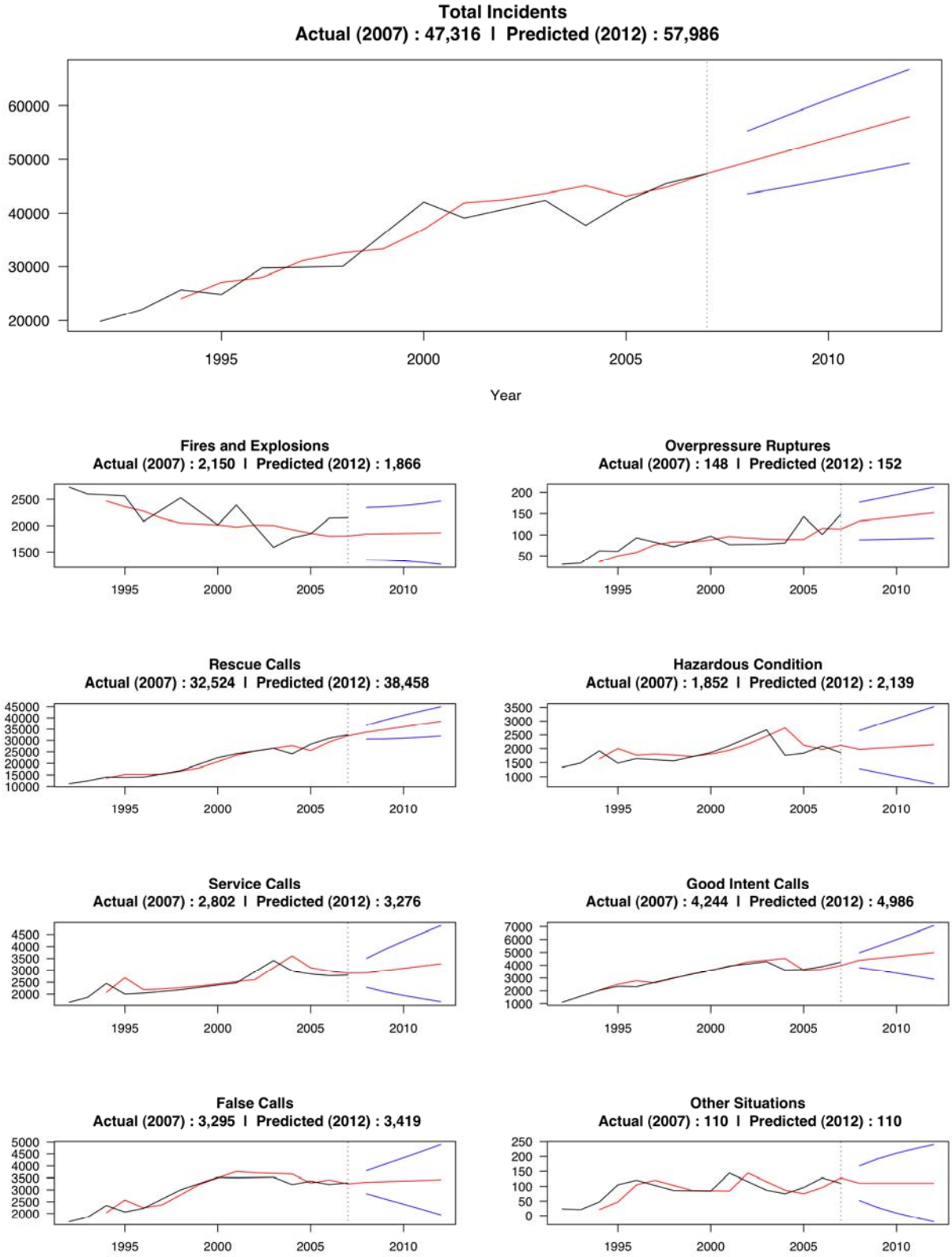
upwards in the late 1990s and early 2000s. The total number of fires accounts for a small percentage of incidents.

Having medical incidents the largest category of calls is consistent with national experience. Among the other incident types, good intent calls and unnecessary alarms, which are typically alarm system malfunctions, have been generally increasing and now both outnumber fire incidents! Unnecessary alarms are likely increasing as a result of the increased number of built-in alarm systems. Intentional false alarms are infrequent occurrences across the county.

Emergency Incident Trends – A statistical time series analysis was used to forecast future demand. This type of analysis is commonly used for predicting everything from water levels in a lake to stock market prices. Time series forecasting makes use of many different statistical models, some more complex then others. The Holt-Winters model used for this demand forecast is relatively simple.

The first step in the process was to calculate historical demand for each of the incident categories, in this case the number of incident responses, for each month. These numbers were then used to plot the actual past demand (as can be seen in black on the all graphs in this section). Using a statistical software package, the Holt-Winters procedure was used to investigate three particular parameters of the time series: the level, the trend, and seasonal variation. The red line shows predicted demand from 2008 through 2012. The red line extends back into years where we have actual data, as a way of showing that the predictions tend to be fairly accurate. The blue lines above and below the predicted demand provide a 95^{th} percentile confidence interval (meaning that statistically there is a 95 percent chance that the actual incident total will fall within that range). Remember that this is a statistical prediction and it is possible to add human judgment into the mix. A solid understanding of the underlying factors that drive demand for local emergency services combined with statistical forecasting like that provided in this section is a powerful combination for successful deployment planning. Figure 4 shows the trends by incident type and projections for the next five years. The black line that stretches from 1992 to 2007 represents actual incident totals for those years. The red line that stretches from 1992 to 2012 represents a best-fit mathematical model built to emulate the incident trend and allow it to be projected. The values from 2008 to 2012 show the predicted incident totals for the next five years. The blue lines above and below the predicted values show the 95 percent confidence interval. The red line that overlaps the black line is included to show how well the mathematical model fits actual data.

Figure 4: Emergency Services Demand


Total Incidents
Actual (2007) : 47,316 | Predicted (2012) : 57,986
Year
Fires and Explosions
Actual (2007) : 2,150 | Predicted (2012) : 1,866
Overpressure Ruptures
Actual (2007) : 148 | Predicted (2012) : 152
Rescue Calls
Actual (2007) : 32,524 | Predicted (2012) : 38,458
Hazardous Condition
Actual (2007) : 1,852 | Predicted (2012) : 2,139
Service Calls
Actual (2007) : 2,802 | Predicted (2012) : 3,276
Good Intent Calls
Actual (2007) : 4,244 | Predicted (2012) : 4,986
False Calls
Actual (2007) : 3,295 | Predicted (2012) : 3,419
Other Situations
Actual (2007) : 110 | Predicted (2012) : 110

The Total Incidents graph in Figure 4 shows that demand for emergency services is rapidly increasing. Since 1992, emergency incidents have more than doubled, from 20,000 to 47,000 incidents. It is expected that this trend will continue, potentially adding another 10,000 incidents over the next ten years. The confidence intervals show a wider range of possible values, but it is reasonable to plan for a 10,000 incident increase, given the increasing population within the county.

As is the trend nationwide, fires are decreasing (as a result of improved construction methods, automatic suppression systems, and alarms), while rescue calls (emergency medical calls) are increasing. Rescue calls have increased 300 percent over the last 15 years. It is expected that the county will have an additional 6,000 rescue calls per year by 2012. Overpressure ruptures, hazmat, service calls, good intent calls, and false calls (including both false alarms and unnecessary alarms) are all on the rise, but the increase is not nearly as dramatic as that for rescue calls. These increases are not unusual for a rapidly growing county like Anne Arundel.

The above graphs show countywide emergency incident trends, but the county is not uniform in its emergency services demand. Appendix A provides the same analysis for each of the individual planning areas.

Emergency Services Workload Forecasts

Using the demand forecasts from the previous section, workload can be predicted for individual stations. We start with the forecast of incidents discussed earlier. Relying on the historic ratio of responses to incidents to estimate total unit responses, and allocating unit responses based on their historic proportion by unit, we develop a forecast of activity by station and unit type. The forecasts have been divided into tables by equipment type (engines, aerials, quints, heavy squads and ambulances). The quints in Anne Arundel are dispatched either as an engine or aerial device depending on the unit type needed for an incident. The computer-aided dispatch (CAD) data provided for this study did not differentiate the quint responses by assignment type. For that reason, a quint forecast is provided in addition to those engines and for aerials.

The ambulance table shows both total responses per station and a breakdown of advanced life support (ALS) and basic life support (BLS) responses. Typically each of the stations has one ambulance that is designated as ALS or BLS, but this designation can change if there is volunteer staffing at the station. At stations 6, 13, 27, and 33, volunteers sometimes staff the ambulance. When this happens, the ambulance designation may switch from ALS to BLS. At stations 2, 13 and 33, there is also the possibility that volunteers staff an additional ambulance.

When looking at total ambulance responses from these stations, it has to be remembered that there may (occasionally) be more than one ambulance staffed.

Table 1: Engine Workload Forecasts by Stations (runs per year)

Station	Actual (2007)	Prediction (2012)	95% Confidence Interval	
			Lower	Upper
1	297	340	232	448
2	987	1130	772	1488
3	2034	2329	1592	3067
4	266	305	208	401
5	2635	3017	2062	3973
6	538	616	421	811
7	1367	1565	1070	2061
9	1221	1398	955	1841
10	1932	2212	1512	2913
11	791	906	619	1193
12	2465	2823	1929	3717
13	1161	1330	909	1751
17	1893	2168	1481	2854
18	3322	3804	2600	5009
19	1177	1348	921	1775
20	936	1072	732	1411
21	165	189	129	249
23	529	606	414	798
26	4104	4700	3211	6188
27	1454	1665	1138	2192
28	2619	2999	2049	3949
29	1867	2138	1461	2815
30	43	49	34	65
31	3515	4025	2751	5300
32	2412	2762	1887	3637
33	3643	4172	2851	5493
34	1217	1394	952	1835
40	4296	4920	3362	6477
41	384	440	300	579
42	779	892	610	1175

Table 2: Aerial Workload Forecasts by Stations

Station	Actual (2007)	Prediction (2012)	95% Confidence Interval	
			Lower	Upper
11	95	109	74	143
26	1610	1844	1260	2427
28	292	334	228	440
31	1070	1225	837	1613
33	1392	1594	1089	2099
40	1604	1837	1255	2418
42	231	265	181	348

Table 3: Quint Workload Forecasts by Stations

Station	Actual (2007)	Prediction (2012)	95% Confidence Interval	
			Lower	Upper
4	1663	1904	1301	2507
13	370	424	290	558
23	1854	2123	1451	2795
30	2175	2491	1702	3279

Table 4: Heavy Squad Workload Forecasts by Stations

Station	Actual (2007)	Prediction (2012)	95% Confidence Interval	
			Lower	Upper
1	153	175	120	231
2	238	273	186	359
7	529	606	414	798
12	602	689	471	908
13	281	322	220	424
23	1075	1231	841	1621
33	73	84	57	110
34	424	486	332	639

Table 5: ALS/BLS Ambulance Workload Forecasts by Station

Station		Actual (2007)	Prediction (2012)	95% Confidence Interval	
				Lower	Upper
1	**Total**	**679**	**778**	**531**	**1024**
	ALS	679	778	531	1024
2	**Total**	**1989**	**2278**	**1556**	**2999**
	ALS	1858	2128	1454	2801
	BLS	131	150	103	198
3	**Total**	**2514**	**2879**	**1967**	**3791**
	ALS	2514	2879	1967	3791
4	**Total**	**2941**	**3368**	**2301**	**4434**
	ALS	2941	3368	2301	4434
5	**Total**	**3257**	**3730**	**2549**	**4911**
	ALS	3257	3730	2549	4911
6	**Total**	**1039**	**1190**	**813**	**1567**
	BLS	1039	1190	813	1567
7	**Total**	**1542**	**1766**	**1207**	**2325**
	BLS	1542	1766	1207	2325
9	**Total**	**1323**	**1515**	**1035**	**1995**
	ALS	1323	1515	1035	1995
10	**Total**	**2564**	**2936**	**2006**	**3866**
	ALS	2564	2936	2006	3866
11	**Total**	**913**	**1046**	**714**	**1377**
	BLS	913	1046	714	1377
12	**Total**	**2886**	**3305**	**2258**	**4351**
	ALS	2886	3305	2258	4351
13	**Total**	**2491**	**2853**	**1949**	**3756**
	ALS	1814	2077	1420	2735
	BLS	677	775	530	1021
17	**Total**	**2900**	**3321**	**2269**	**4373**
	ALS	2900	3321	2269	4373
18	**Total**	**3434**	**3932**	**2687**	**5178**
	ALS	3434	3932	2687	5178
19	**Total**	**1653**	**1893**	**1294**	**2492**
	BLS	1653	1893	1294	2492
20	**Total**	**1498**	**1715**	**1172**	**2259**
	BLS	1498	1715	1172	2259
21	**Total**	**2254**	**2581**	**1764**	**3398**
	ALS	2254	2581	1764	3398
26	**Total**	**3823**	**4378**	**2992**	**5764**
	ALS	3823	4378	2992	5764

Station		Actual (2007)	Prediction (2012)	95% Confidence Interval	
				Lower	Upper
27	**Total**	**1508**	**1727**	**1180**	**2274**
	ALS	1450	1660	1135	2186
	BLS	58	66	45	87
28	**Total**	**2981**	**3414**	**2333**	**4495**
	BLS	2981	3414	2333	4495
29	**Total**	**2167**	**2482**	**1696**	**3267**
	ALS	2167	2482	1696	3267
30	**Total**	**2787**	**3192**	**2181**	**4202**
	ALS	2787	3192	2181	4202
31	**Total**	**3432**	**3930**	**2686**	**5175**
	ALS	3432	3930	2686	5175
32	**Total**	**2968**	**3399**	**2323**	**4475**
	ALS	2968	3399	2323	4475
33	**Total**	**4472**	**5121**	**3499**	**6743**
	ALS	3844	4402	3008	5796
	BLS	628	719	491	947
34	**Total**	**3060**	**3504**	**2395**	**4614**
	BLS	3060	3504	2395	4614
40	**Total**	**3164**	**3623**	**2476**	**4771**
	ALS	3164	3623	2476	4771
41	**Total**	**1527**	**1749**	**1195**	**2302**
	BLS	1527	1749	1195	2302
42	**Total**	**1110**	**1271**	**869**	**1674**
	ALS	1110	1271	869	1674

We used a threshold of 3,000 responses per year as an indication that a unit's activity level is high enough to be unavailable for a significant share of the responses in its first-due district. Those units would likely have increased response time averages if no relief were added to handle the increase in calls. The more a unit is out of station on calls, the more have to be answered by the next closest unit. The 3000 is not a firm rule, just a flag of the level where reduced availability often becomes a major factor in degradation of response times.

- The average EMS call turnaround time (provided by AACoFD) was 48 minutes. Using this average, an EMS transport unit with 3000 runs would have an approximate unit hour utilization level of almost 30 percent (meaning that the unit would be unavailable 30 percent of the time). AACoFD has several ambulances that either already exceeds or is expected to exceed 3000 calls. Each of these units has been marked in red and special

consideration should be given to either changing response areas to better balance workloads or adding units to prevent these units from gaining additional workload.

- The same 3000 run threshold can also be used for fire apparatus. Although the unit hour utilization for fire apparatus with 3,000 responses is typically far lower than what was discussed for ambulances, this threshold tends to still be a good indicator of fire apparatus reliability. The good news is that the heavy squads and aerial apparatus all are expected to remain well under the 3000 threshold through 2012. Engines at stations 9, 17 and 33 are above the threshold. This does not necessarily mean that they are overworked, but should receive some additional attention.

Small Planning Area Analysis

This section starts by providing descriptions of each of the small planning areas (based on information from the Anne Arundel County Planning Department). After that, we review their population and population densities. Finally, we look at several important inter-planning area comparisons including total incidents, the financial cost of fires, fire deaths, and the number of multiple alarm fires. Understanding this information is very important for making deployment decisions. Appendix B shows the land use breakdown for each planning area.

Annapolis Neck – The boundary of the area commonly referred to as the Annapolis Neck follows the Chesapeake Bay and the South River to the south and west, then to the north follows U.S. Route 50, then the Parole Growth Management Area boundary (Defense Highway, Housley Road, and Generals Highway), and then Saltworks Creek and its headwaters, and finally is bounded by the Severn River to the east. This entire area comprises approximately 14,600 acres of land. Within this area lies the incorporated City of Annapolis, which contains approximately 4,600 acres of land. The City of Annapolis adopts and administers its own Comprehensive Plan governing all property within the City limits. Therefore, the Annapolis Neck Small Planning Area consists of the remaining 10,000 acres, approximately, of the Annapolis Neck which fall under the jurisdiction of Anne Arundel County. This area includes approximately 1,500 acres of land that lie within the County's designated Parole Growth Management Area (PGMA).

Broadneck – The Broadneck Small Planning Area encompasses 16,184 acres or 25.3 square miles, which is approximately 6% of Anne Arundel County. It includes the North Severn Naval Station and Sandy Point State Park. The Broadneck Peninsula is situated between the Magothy River to the north, the Severn River to the south and the Chesapeake Bay to the east. With 75 miles of shoreline, this represents 14% of the County's 533 miles of shoreline.

Maryland Route 2 and U.S. Route 50 divide the peninsula and provide access to the residents. The Broadneck planning area is home to approximately 8% of all County residents.[8]

Brooklyn Park – The history of the Brooklyn Park Small Planning Area is closely related to the growth and development of Baltimore. The area's strategic location within Anne Arundel County's major transportation corridors and its proximity to the Patapsco River, Curtis Bay and the Chesapeake Bay also played significant roles in the evolution of Brooklyn Park and its surrounding communities. While the population in Anne Arundel County has grown steadily over the past few decades, increasing 64 percent from 1970 to 2000, the population in Brooklyn Park has actually declined by 21 percent since 1970 to a population in 2000 of 13,642 persons. However, the county projects that this area will grow over the next 25 years.

BWI/Linthicum – The BWI/Linthicum region lies within one of the most densely populated and developed areas of the County. Like its neighboring planning areas of Odenton and Jessup/Maryland City, the BWI/Linthicum area is part of an important transportation corridor, a factor that has directed its historical development. This area is bounded generally by the Patapsco River to the north and west, Dorsey Road and MD 100 to the south, and Interstate 97 and Baltimore Annapolis Boulevard to the east. The area is comprised of approximately 12,500 acres (20 square miles) of land.

Crofton – The Crofton area lies in the central western region of Anne Arundel County. Flanked on the west by the Little Patuxent River, the planning area includes the historic rural communities of Rutland and Conway and the modern suburban community of Crofton. It is strategically located midway between Annapolis and the Washington Beltway. Based on current projections, the population of the Crofton Small Area will increase to 32,878 by the year 2020. This represents an almost 21% increase in population between 1999 and 2020. By comparison, Anne Arundel County is projected to grow by less than 14% during the same time period.

Crownsville – The Crownsville area, located northwest of Annapolis, is a sparsely populated suburban area. It is characterized by rolling topography, of which a significant portion is forested. The extensive shoreline of the Severn River, with its numerous peninsulas and coves, forms the eastern boundary of the area.

Deale/ Shady Side – The Deale/Shady Side Small Planning Area is located in the southeast portion of the County. It is bordered on the east by the Chesapeake Bay and surrounded on all other sides (the west, north and south) by the rolling low-density agricultural

[8] http://www.aacounty.org/PlanZone/SAP/Resources/sap_broadnk_demo.pdf

land of South County. From 1980 to 1990, this area experienced a 30% population increase with another 14% increase from 1990 to 2000.

Edgewater/Mayo – The Edgewater/Mayo Small Planning Area extends along both sides of Riva Road to the west to the tip of the Mayo peninsula to the east. The northern boundary of the planning area is the South River while the southern boundary is formed by Central Avenue, extending south of MD 214 to include the South River Colony residential planned development. A large portion of the planning area is located on or near the South River, Rhode River and the many creeks that extend into the communities on the peninsula.

Glen Burnie – The history of the Glen Burnie Small Planning Area is closely linked to the growth and development of the town of Glen Burnie, as well as its strategic location within Anne Arundel County's major transportation corridor. The Glen Burnie Small Planning Area is bounded by the Baltimore Beltway (I-695), I-97, Brightview Drive, Obrecht Road, Ritchie Highway, Mountain Road, Solley Road, Marley Creek, Furnace Creek, and Curtis Creek. Population forecasts indicate that the Glen Burnie area will continue to experience growth over the next 25 years, although at a relatively slower rate.

Jessup/Maryland City – The Jessup/Maryland City Small Planning Area is bounded generally by Howard County to the west, the Patuxent River and Prince Georges County to the south, the Patuxent Research Refuge, Fort Meade, and the Baltimore Washington Parkway to the east, and MD 100 to the north. Between 1990 and 2000, the area's population grew by 42 percent, making it the second-fastest growing Planning Area in the County, behind Crofton.

Lake Shore – The Lake Shore area is essentially rural in character and less densely developed. The area's shoreline comprises part of the Chesapeake Bay Critical Area where limited development and resource conservation are essential. In comparison to the County as a whole, Lake Shore has not experienced the same growth from 1990 to 2000. By 2010, the population forecast for this area is 26,658, an increase of only 585 persons from 2000.

Odenton – Odenton is centrally located between Baltimore and Washington. The Baltimore-Washington Parkway (I-295), is a major north/south highway and along with MD-32 and I-97, it connects the area to Annapolis. MD 175 runs east/west through the middle of the Odenton Town Center, serving as a gateway. In addition to an efficient road network, the area is readily accessible by mass transit with the Odenton MARC station located in the center of the area. The greatest impact to the Odenton Small Planning Area was the arrival of Fort Meade in 1917 when the U. S. War Department acquired 19,000 acres of land west of Odenton to develop a training camp. The combined development of Fort Meade, the National Security Agency and BWI Airport in the 20th century as well as suburban expansion of Baltimore and Washington, D.

C. and the County's own efforts in targeting growth in the west County area, have transformed this area from a mostly farmland region to a business, residential and industrial center.

Pasadena/ Marley Neck – The Pasadena/Marley Neck Small Planning Area is primarily developed with a mix of older waterfront communities and newer infill on upland sites. The residents consider the location of this area and its proximity to the water one of its greatest assets. Older, established residential communities exist around Cox Creek, Nabbs Creek, Stoney Creek and Rock Creek with commercial areas along Mountain Road and Fort Smallwood Road. Heavy industrial areas and business parks are located in Marley Neck area with scattered residential and industrial areas south of Mountain Road.

Severn – Severn is located just south of BWI Airport and encompasses the heart of northern Anne Arundel County. The road infrastructure includes the Baltimore Washington Parkway (MD 295), MD 100, MD 32 and I-97. The area is only minutes from several MARC train stations, located in Odenton's Town Center, Savage, Laurel, Dorsey and Jessup. Severn is also in close proximity to the Baltimore Washington International Airport (BWI). With the growth of Fort Meade, the National Security Agency, and BWI Airport, as well as suburban growth of Baltimore and Washington D.C., this area is making a dramatic transformation from farmland to suburbia.

Severna Park – Severna Park contains a number of small communities, some of which were once summer cottages along the shores of the Severn and Magothy River. Neighborhoods of densely built bungalows around the water created a strong sense of community among its residents. Many of these communities along the Severn and Magothy Rivers have community water access. Until the 1980's, most of the commercial businesses had been local neighborhood stores and shops and were distributed throughout Severna Park, mostly along Veteran's Highway and around Jumper's Hole Road.

South County – This area includes primarily all of the land south of MD 214, but also extends to just north of MD 50 on the western side of the County. South County is bounded by the Patuxent River on the west and the Chesapeake Bay and Deale/Shady Side and Edgewater Small Planning Areas on the east. The area is characterized by large expanses of rolling farmland and woodland, low density residential use, numerous historic structures and sites, and historic and scenic roads that traverse the landscape. Business within South County is based on a rural economy, which is defined as traditional and non-traditional agricultural, horticultural, forestry and maritime pursuits and compatible home-based businesses.

Population and Population Densities

Table 6 shows population and land area information for all the planning areas. We can see from this table the following:

- Fastest Growing Areas: Annapolis Neck, Crofton, Pasadena/ Marley Neck
- Most Populous Areas: Glen Burnie, Broadneck, Odenton
- Most Land Area: Odenton, Crownsville, Broadneck
- Highest Population Density: Glen Burnie, Brooklyn Park, Severn

Table 6: Small Planning Area Population, Land Area, and Density Data

Small Planning Area	1980	1990	2000	Growth	Pop.	Land Area (sq. mi.)	Area	Density
Annapolis Neck	12,076	17,735	22,609	87%	5%	15.67	4%	1,443
Broadneck	26,504	36,236	38,250	44%	8%	25.16	6%	1,520
Brooklyn Park	14,080	13,664	13,642	-3%	3%	4.18	1%	3,260
BWI/ Linthicum	18,224	18,413	17,072	-6%	3%	19.55	5%	873
Crofton	15,255	18,287	27,243	79%	6%	18.63	5%	1,463
Crownsville	10,999	13,650	15,438	40%	3%	30.78	8%	502
Deale/ Shady Side	7,399	9,672	11,116	50%	2%	13.23	3%	841
Edgewater/ Mayo	14,754	14,550	16,884	14%	3%	12.16	3%	1,388
Glen Burnie	67,346	71,433	73,951	10%	15%	19.56	5%	3,781
Jessup/ Maryland City	13,218	14,441	20,522	55%	4%	14.32	4%	1,433
Lake Shore	N/A	24,373	26,073	7%	5%	22.07	5%	1,181
Odenton	29,771	28,203	37,916	27%	8%	50.90	13%	745
Pasadena/ Marley Neck	20,019	27,195	33,239	66%	7%	17.62	4%	1,886
Severn	25,097	30,466	36,896	47%	8%	17.69	4%	2,085
Severna Park	25,896	32,388	35,367	37%	7%	16.17	4%	2,187
South County	14,001	16,035	17,267	23%	4%	108.69	27%	159
Anne Arundel County	370,775	427,239	489,656	32%	100%	406.39	100%	1,205

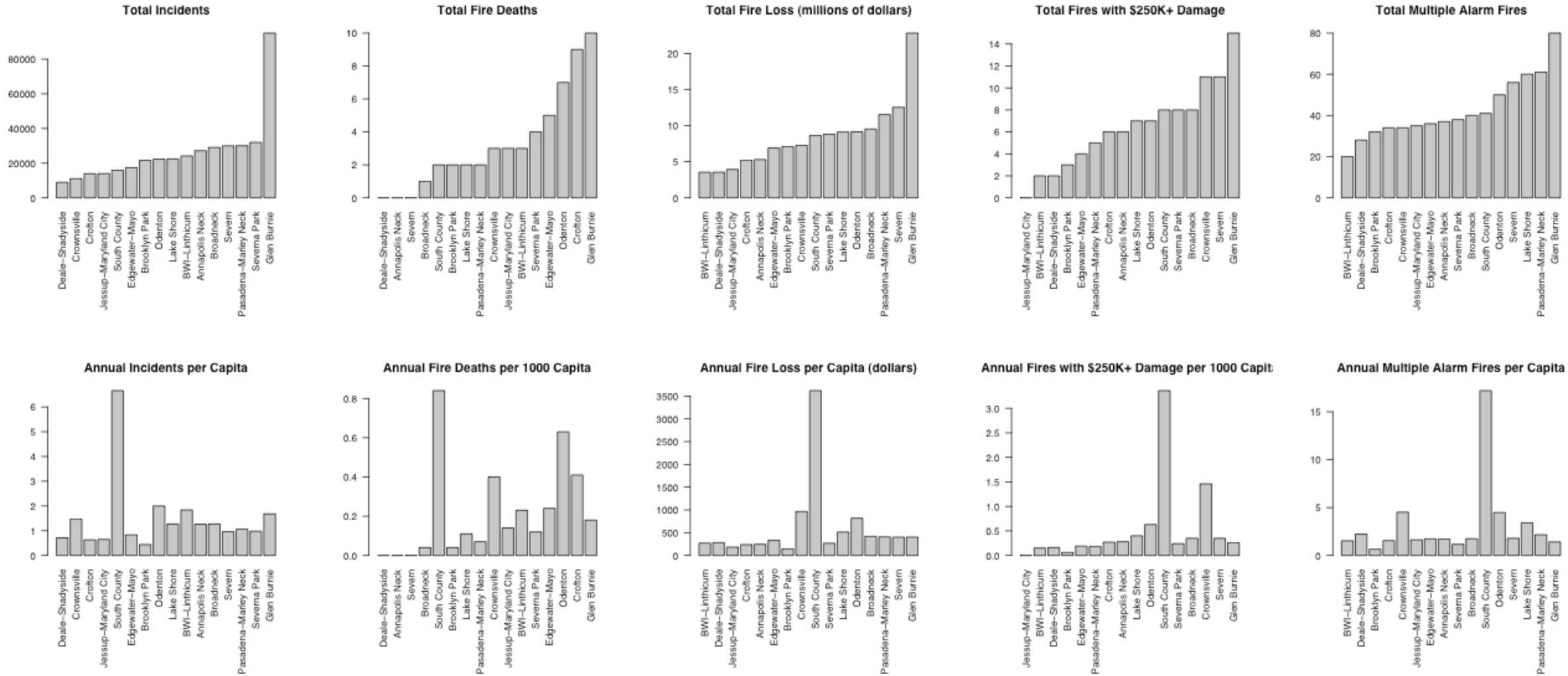
Risk Comparisons Among Planning Areas

Figure 5 shows planning area comparisons for total incidents, total fire deaths, total fire loss (financial), number of high fire loss incidents, and number of multiple-alarm fires. Because some of the small planning areas are much more populous than others, the per capita version of this analysis is found in the row of graphs just below. Understanding how different parts of the county have different risks and risk levels are important to recommendations for improved emergency services delivery throughout the rest of this report.

Not surprising, Glen Burnie leads all of the total categories, largely because it has almost twice the population of the second most populous planning area and dwarfs the majority of the planning areas in size. When the same comparisons are calculated per capita, Glen Burnie appears much closer to the average level of risk.

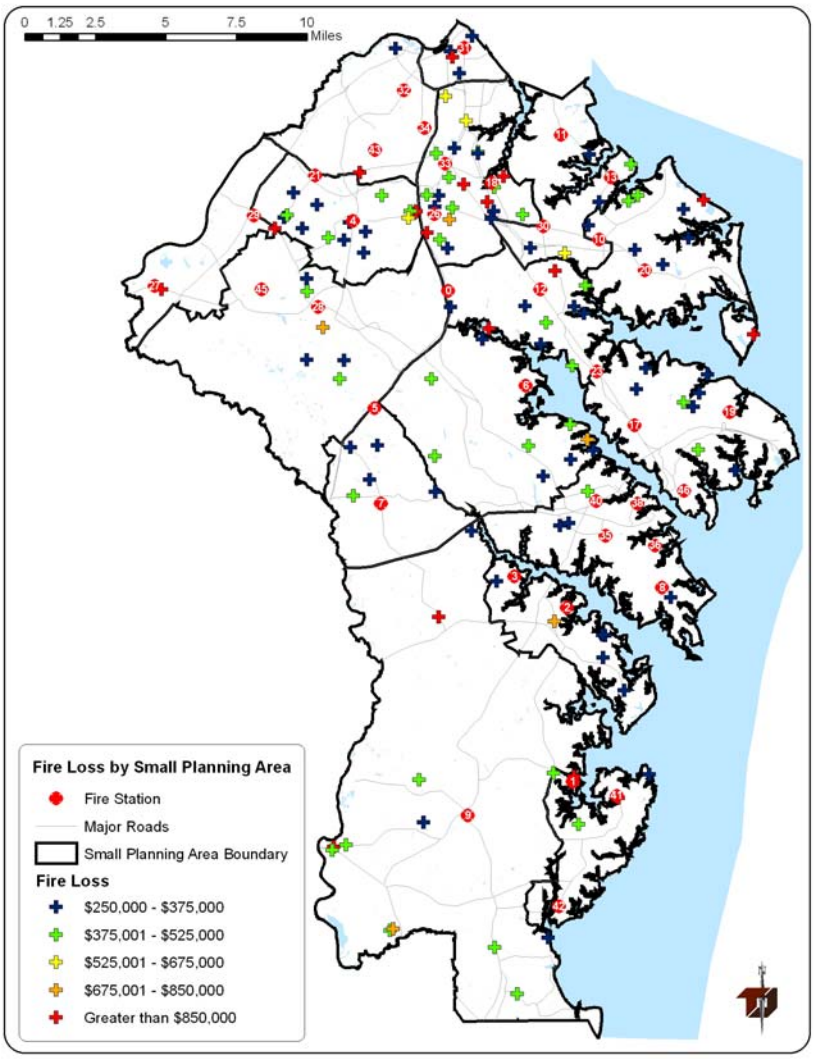
In the per capita comparisons, South County leads in all of the fire risk categories. South County has the lowest population density (159 people / square mile) and it may be that slow response times are allowing fire incidents to grow much larger than other parts of the county. But that does not explain why they have more fire incidents per capita to start with. The next chapter will consider the need for reasonable response times in rural areas of the county such as South County while keeping in mind that very populous areas of the county such as Glen Burnie will need the most resources for handling a high level of emergency services demand.

Figure 5: Inter-Planning Area Fire Loss Comparisons



Another way of looking at this fire loss data is by mapping it out using a geospatial software program. Figure 6 represents the same data shown in the planning area comparisons, except that here we can see exactly where each event occurred within the small planning area.

Figure 6: High Financial Fire Loss Incidents, 1992–2007



III. RESPONSE TIME AND STATION LOCATION ANALYSIS

This chapter discusses the deployment of fire stations and emergency response apparatus in Anne Arundel County. As discussed in the previous chapters, there are many factors that should be taken into account when determining the appropriate number of stations, including demand for services, population density, size of the jurisdiction, and desired response times. This chapter considers these factors for the current and future deployment.

Data

Before the analysis took place, project team members gathered and reviewed information related to properly locating fire stations, including:

- Current station locations and county/volunteer staffing
- Current apparatus deployment
- Current risk areas
- Current and projected population
- Current and projected demand
- National response time standards

Response data from the Computer Aided Dispatch (CAD) system for 10 years (1998 through 2007) was provided by AACoFD. The data included addresses for geocoding, responding units, and response time segments.[9] Geographic Information System (GIS) files were also provided by the county.

The data provided by the county was rather complete and detailed. However, one key piece of information lacking was the home station for each unit, which is not included in the CAD data. To get around this problem, the responding unit ID field was used to identify the home station. A list of the responding unit IDs was sent to AACoFD which then matched the unit IDs to the home station based on the county unit numbering system. It is assumed for this analysis that the unit responded from the home station and not elsewhere in the county.

[9] A GIS operation for converting street addresses into spatial data that can be displayed as features on a map, usually by referencing address information from a street segment data layer.
ESRI Support Center, "GIS Dictionary," ESRI, http://support.esri.com.

Another data limitation relates to the way units are staffed. The County assigns personnel to a particular station and those personnel staff the first-out unit. For example, if a station has two career personnel assigned and a medic and engine, the two career personnel would staff the unit required on the first call—if it's a medic call, then they staff the medic unit; conversely, if it's a fire call, then they staff the engine. Any potential variations in career and volunteer units and/or stations could not be completed due to this cross staffing at some stations.

Response Time Analysis

The first step in the deployment analysis was a review of department-wide response times. Response time is the total elapsed time between an individual calling 911 and emergency service personnel arriving at the scene. Response time can be broken down into multiple intervals for analysis: call processing, dispatch, turnout, and travel times.

The following response time analysis is based on emergency responses for fire/EMS apparatus including engines, trucks, quints, tankers, rescue units, ambulances, and medic units. Not included are command units, air units, and boats. Test incidents and other non-emergency responses were excluded as well.

In some cases, there were invalid entries in incident files (e.g. no time was recorded) or obvious errors (e.g. the unit arrived before the call came in). These were excluded from the dataset used in the analysis. Also eliminated were outliers that were more than three standard deviations from the mean. If response times have an approximately normal distribution, 99.7 percent of incidents are expected to fall within three standard deviations of the mean, and the 0.3 percent of incidents that were excluded from the response time analysis likely contain errors.

NFPA Standards – National standards, such as those established by the National Fire Protection Agency (NFPA), provide reasonable means for assessing performance with regard to response times. Different standards have been established for career and volunteer services. Since Anne Arundel County uses a combination of career and volunteer personnel, there is no single set of applicable response time standards. Instead, NFPA 1710 for career agencies and NFPA 1720 for volunteer departments should both be considered as guidelines. Table 7 and Table 8 summarize the response time goals established in each standard.

Table 7: NFPA 1710 Response Time Objectives for Career Departments

Time Segment	Response Time	Percentile
All Calls: Turnout	01:00	90
Fire Suppression		
First Arriving Engine Company	04:00	90
Full First Alarm	08:00	90
EMS		
First Responder	04:00	90
ALS Unit	08:00	90

Table 8: NFPA 1720 Staffing and Response Time Guidelines for Volunteer Departments

Type of Demand Zone	Criteria	Staffing/Response Time	Percentile
Special Risks	Set by jurisdiction	Set by jurisdiction	90
Urban	Greater than 1000 persons per sq mi	15 / 09:00	90
Suburban	500 to 1000 persons per sq mi	10 / 10:00	80
Rural	Less than 500 persons per sq mi	6 / 14:00	80
Remote	Travel distance 8 miles or greater	4	90

The response time and deployment recommendations developed for this study considered both standards and we analyzed the number of calls reached within four, six, and eight minutes.

Call Processing and Dispatch Time – Call processing time includes the time to get information from the caller and enter it into a new dispatch system record. This is measured from the time the call is received to the time the call is transferred to a dispatcher. Dispatch time begins when the call is transferred from the call-taker to a dispatcher and continues until units are alerted to respond. Anne Arundel County, like many other jurisdictions, considers call processing and dispatch together as a single time segment. It is also important to note that the first contact for all incoming calls is handled by the police, who then transfer identified fire, EMS, and rescue calls to the fire department for processing. Therefore the call processing time for Anne Arundel County is for the fire department only, and does not include the time for police to classify and transfer the call. As a result, call processing time is measured from the time the call is received by the fire department until the time the unit is dispatched.

For 2003 through 2007, call processing and dispatch times for AACoFD averaged 1 minute 28 seconds and had a 90th percentile time of 2 minutes 21 seconds for first dispatched units as shown in Table 9. The county reached the 2 minute mark at the 82nd percentile.

Table 9: Call Processing and Dispatch Times

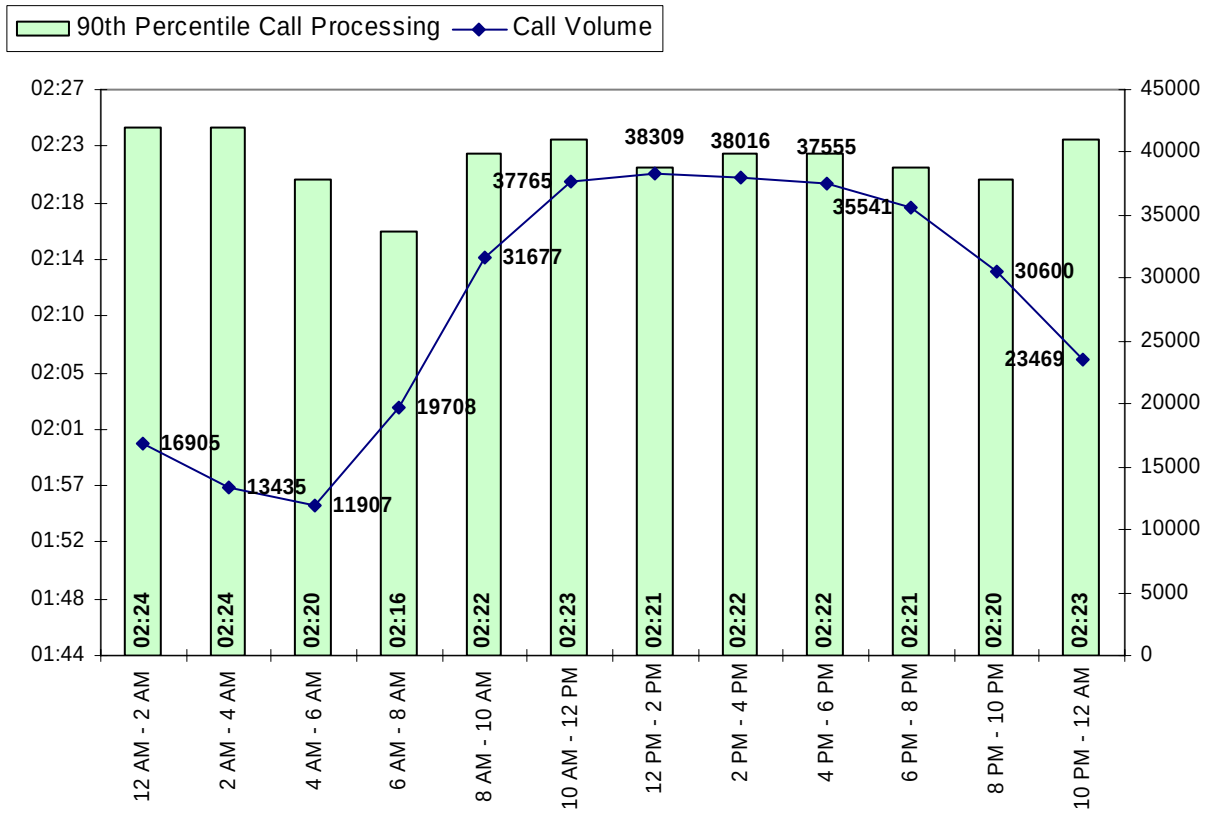
	Fire	EMS	Rescue	All
Average	01:12	01:33	01:37	01:28
90th Percentile	01:58	02:24	02:55	02:21

When examined by call type, fire calls had a 90th percentile time of 1 minute 58 seconds, EMS calls had a 90th percentile time of 2 minutes 24 seconds, and rescue calls had a 90th percentile time of 2 minutes 55 seconds. The processing time difference between each call type is nearly 30 seconds, with fire calls being processed the quickest. The variation among fire, EMS, and rescue calls may be due to the degree of precision needed to locate a specific call or patient. Fire calls may require less precision in eliciting an exact address, and for alarmed incidents, the exact location is provided. EMS calls require more precise patient locations and may require additional details. Rescue calls have a high probability of location error, especially on complex scenes such as divided highways and overpasses. However, all call types have fairly high processing times which may be due to multiple call transfers in the county call processing procedures.

The Anne Arundel County CAD system imitates the CAD event upon acceptance of the call and its entry into the system. It is uncertain how much time elapses between actual receipt of the call and entry into the CAD system. There are several potential sources of delay as the call is initially answered and categorized as a fire/EMS/rescue call by the police department, then transferred to the fire department call taker, and finally prioritized and dispatched by the fire department. This is also a potential source of error in evaluating the call processing times, as the recorded time for "call received" may not actually be the time that the call was initially answered. With that said, call processing times are higher than the 90th percentile goal of two minutes, and the efficiency of the current call taking protocol should be examined to get calls processed and dispatched as quickly as possible.

Call processing times remained fairly consistent throughout the day as shown in Figure 7. Despite call volumes from a low of 11,907 calls between 4 AM and 6 AM to a high of 33,309 between noon and 2 PM, call processing times varied by no more than 8 seconds throughout the day.

Figure 7: 90th Percentile Call Processing Times and Incident Volumes by Time of Day



Turnout – Turnout is the time segment beginning when the units acknowledge notification of the emergency to the initial point of response time.[10] National standards for career agencies suggest a turnout time of one minute at the 90th percentile; no nationally-accepted turnout time goal exists for volunteer agencies.

The average turnout time for AACoFD units responding to emergency incidents for 2003 through 2007 was 1 minute 50 seconds with a 90th percentile time of 2 minutes 59 seconds, well above the one minute 90th percentile goal. Table 10 shows the mean and 90th percentile turnout time by call type. Similar to call processing, the times varied by type of call with EMS incidents having the shortest turnout times. This can be expected as fire incidents are more likely to require the donning of protective equipment before leaving the station.

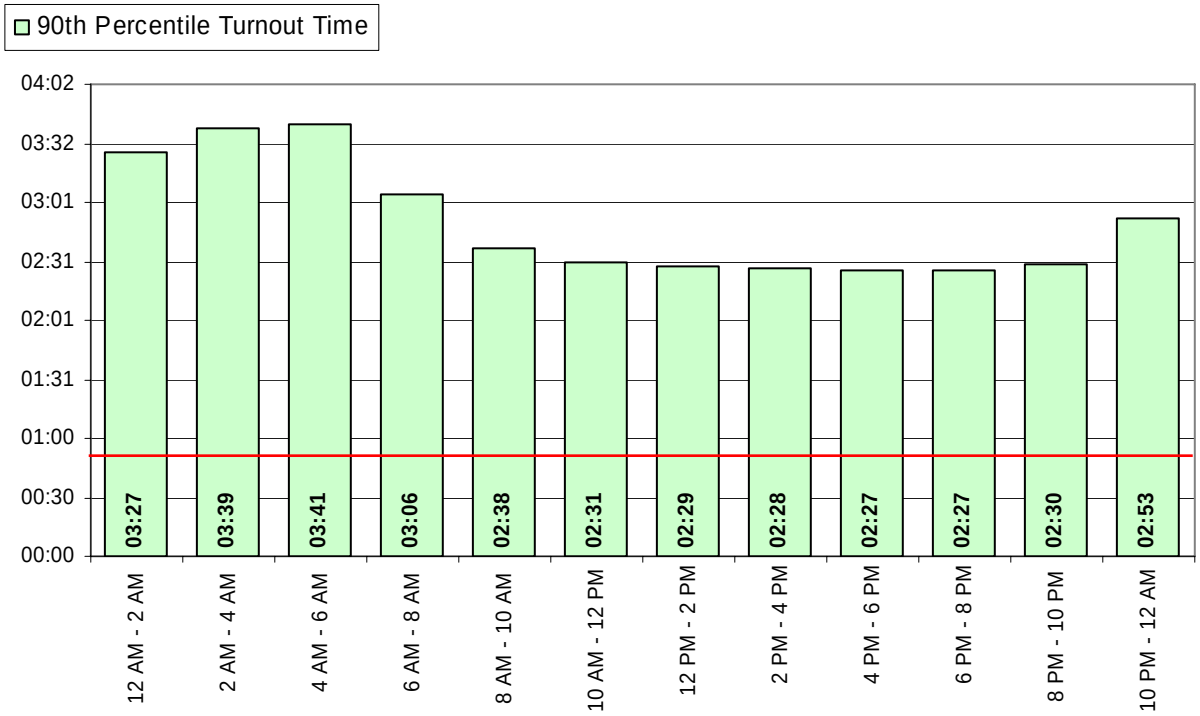
[10] Russ Johnson and Mike Price, "GIS for Fire Station Locations and Response Protocols," in *Fire Protection Handbook*, ed. Arthur E. Cote, P.E., et al (Quincy: National Fire Protection Association, 2008), 12.215-12.231.

Table 10: Average and 90th Percentile Turnout Times by Call Type

	Fire	EMS	Rescue
Average	01:54	01:40	01:59
90th Percentile	03:04	02:46	03:36

Unlike call processing, there were significant variations in turnout time when examined by time of day. As shown in Figure 8, turnout times were less during the late morning through the evening. Turnout times dramatically increased during the overnight hours of 12 AM to 6 AM by over a full minute in comparison to other times of the day.

Figure 8: 90th Percentile Turnout Times by Time of Day



Variations in turnout time were not as apparent when comparing average and 90th percentile times by station location (small planning area). Table 11 shows the average and 90th percentile turnout times by small planning area.

Table 11: Average and 90th Percentile Turnout Time by Small Planning Area

Small Planning Area	Average	90th Percentile
Annapolis Neck	01:30	02:30
Broadneck	01:52	02:56
Brooklyn Park	01:53	02:46
BWI/Linthicum	01:50	02:55
Crofton	01:45	02:50
Crownsville	01:51	03:04
Deale/Shady Side	01:50	02:57
Edgewater/Mayo	01:39	02:47
Glen Burnie	01:38	02:31
Jessup-Maryland City	01:52	03:02
Lake Shore	01:54	02:59
Odenton	01:33	02:44
Pasadena/Marley Neck	01:37	02:47
Severn	01:50	02:46
Severna Park	01:43	02:48
South County	01:47	02:45

Travel Time – Travel or drive time is the time beginning when units are en route to the incident and ending when units arrive on scene (wheel start to wheel stop).[11] Station and apparatus placement geographically have the biggest impact on travel time, although apparatus are not always in the station when dispatched to an incident. Additional factors influencing travel time include traffic, weather, traffic limiting devices (stop lights, speed bumps, etc.), and driver familiarity with the area. Traffic congestion, weather, and traffic limiting devices are beyond the department's control; however, driver knowledge is not.

For 2003 through 2007, AACoFD travel times averaged 3 minutes 38 seconds and had a 90th percentile time of 6 minutes 22 seconds for first arriving units responding within their first due areas. When examined by call type, travel times for the first arriving unit on EMS calls within their respective first due area were shorter than on fire calls, with 90th percentile times of 6 minutes 12 seconds and 7 minutes 13 seconds, respectively. Table 12 shows the average and 90th percentile times for all calls and by call type.

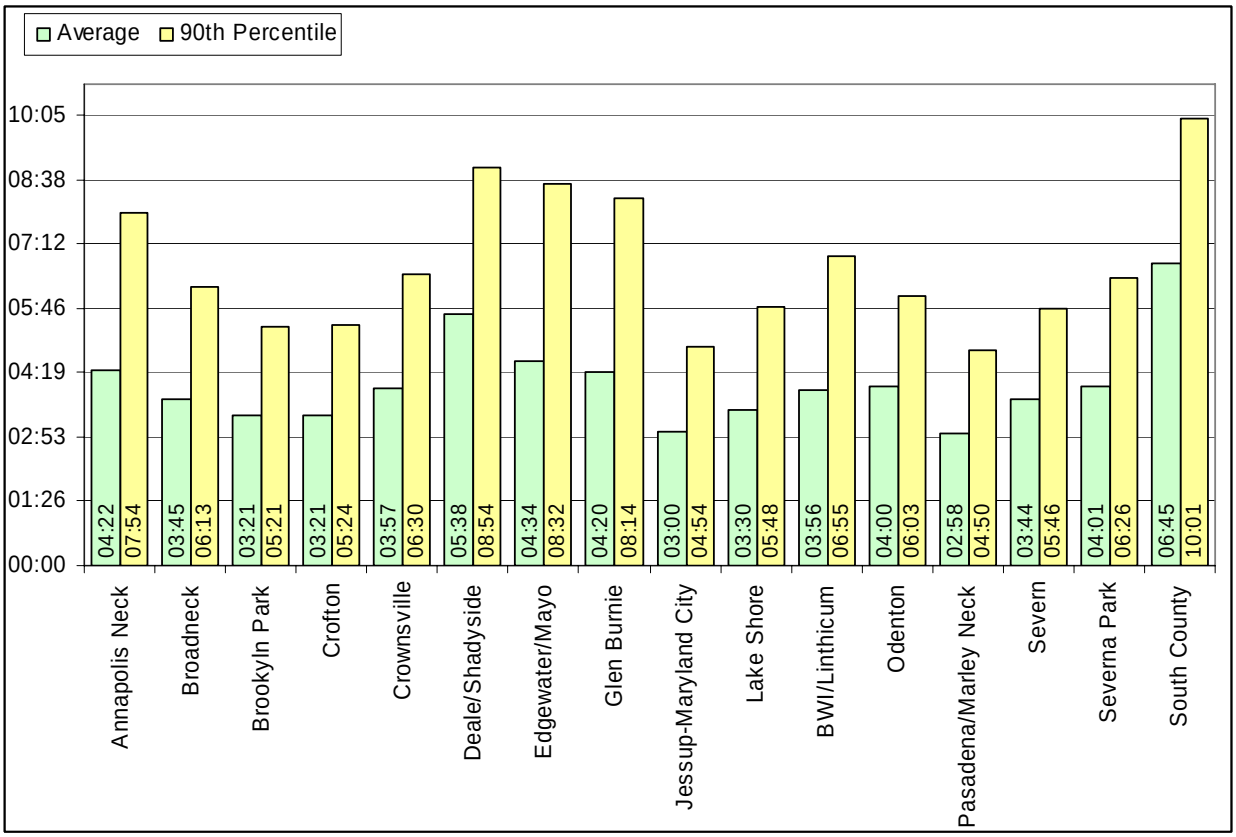
[11] Russ Johnson and Mike Price, "GIS for Fire Station Locations and Response Protocols," in *Fire Protection Handbook*, ed. Arthur E. Cote, P.E., et al (Quincy: National Fire Protection Association, 2008), 12.215-12.231.

Table 12: Travel Times by Call Type for First Arriving Units within their First Due

	Fire	EMS	Rescue	All
Average	03:59	03:34	03:00	03:38
90th Percentile	07:13	06:12	05:25	06:22

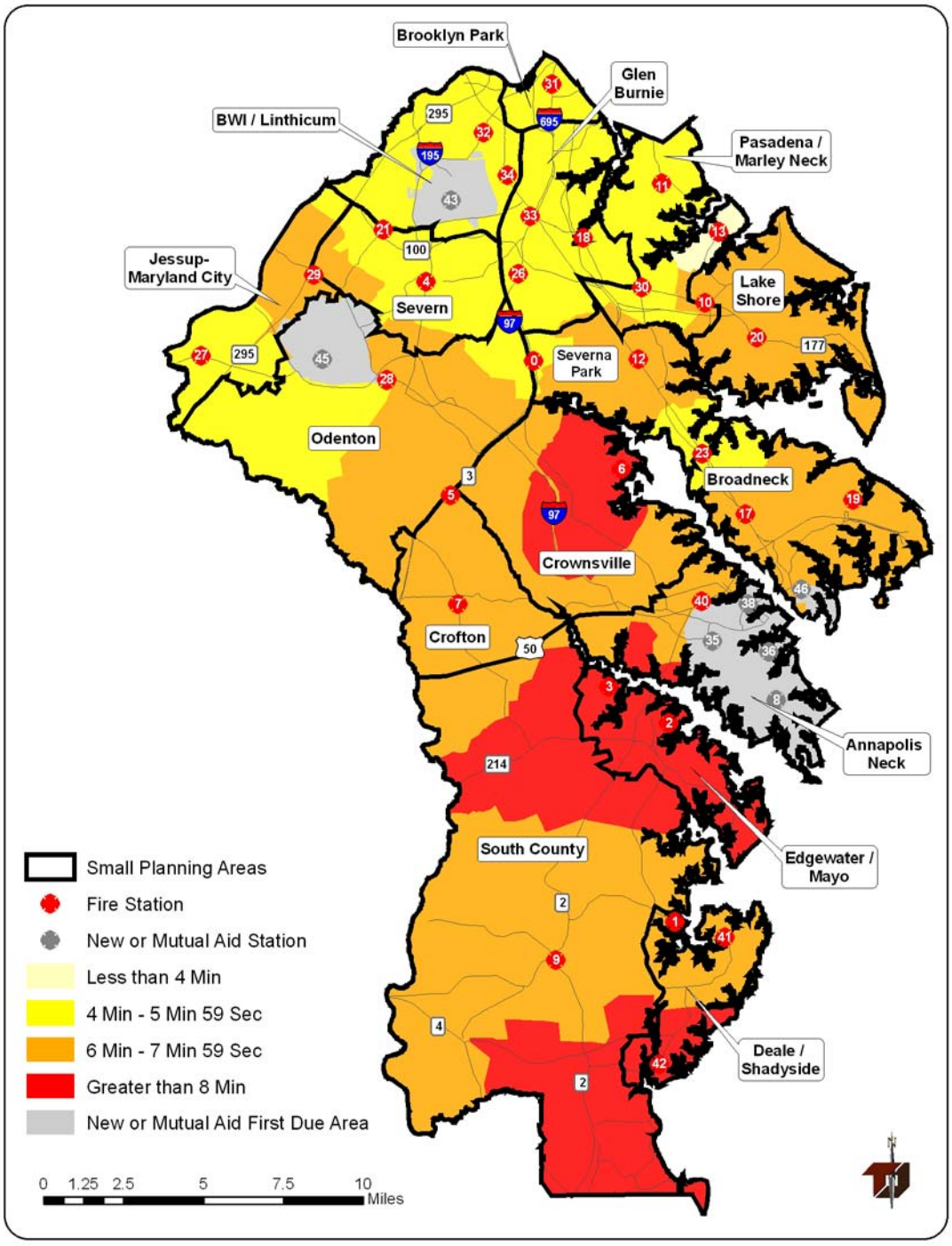
Travel times were also analyzed by station location in relation to the small planning area. Figure 9 shows the average and 90th percentile travel time for first arriving units responding within their first due areas. The variations in travel time are expected and consistent with the geographical characteristics of each small planning area.

Figure 9: Travel Times by Small Planning Area for First Arriving Units within their First Due



Map 1 shows travel times by each station's first due area. Travel times are generally good in the northern part of the county and become higher in the southern, more rural areas. This is to be expected and will be addressed later in this report for areas where there are high concentrations of incidents.

Map 1: 90th Percentile Travel Times by First Due Area



Travel times also varied by apparatus type, as shown in Table 13. Squads, trucks, engines, and ambulances had the lowest travel times for incidents within the first due area. Engines and medic engines (one ALS provider) had the lowest travel times for all incidents, regardless of the first due response area. The number and location of available unit types for a particular incident may affect travel time. Specifically, medic travel times are generally higher

than ambulance response times, as ALS units are busier and may be responding to incidents from other locations besides the home station as explained in the data section. Tankers have the highest travel times as expected since they typically respond as part of the complement.

Table 13: Travel Times by Apparatus Type

	Incidents In The First Due			All Incidents		
Unit Type	Average	90th Percentile	Number* (Percent)	Average	90th Percentile	Number*
Engine	03:43	06:34	170585 (76%)	04:13	07:39	223277
Medic Engine (1 ALS provider)	04:18	07:15	1656 (84%)	04:43	08:28	1961
Truck (aerial ladder)	03:32	05:56	11261 (52%)	04:59	09:21	21459
Tower	04:07	07:42	5851 (54%)	04:51	09:28	10858
Tanker	06:10	10:45	505 (29%)	08:22	14:38	1732
Ambulance (BLS)	03:50	06:40	89374 (49%)	05:03	09:10	180908
Medic (1 ALS provider)	04:19	07:48	23295 (54%)	05:42	10:22	42751
Rescue/Squad	03:11	06:01	4727 (43%)	05:26	11:01	10975
Paramedic (2 ALS providers)	04:04	07:06	44740 (54%)	05:11	09:10	83564

* Valid responses[12] in the first due area

Total – Total response time is the time elapsing between receipt of the emergency call and arrival of the responding unit to the scene of the incident. From a citizen's point of view, this is the amount of time elapsing from their initial request for service until that request is fulfilled by a fire or EMS unit arriving at the incident location.

In Anne Arundel County, total response times averaged 7 minutes 6 seconds for the first arriving unit with a 90th percentile time of 10 minutes 40 seconds. For incidents in the station's first due area, total response times averaged 6 minutes 55 seconds with a 90th percentile time of 10 minutes 11 seconds. Both average and 90th percentile total response times were lower for EMS incidents than fire incidents for first arriving units within the first due area and overall, as shown in Table 14. These variations are expected given the previous time segment differences.

[12] Valid Responses are those that have an associated travel time in the CAD data. Excluded responses are times greater than 3 times the standard deviation, missing travel time data, or inaccurate travel time data.

Table 14: Total Response Times by Call Type

	Incidents In The First Due		All Incidents	
Call Type	Average	90th Percentile	Average	90th Percentile
Fire	07:37	11:37	09:58	16:47
EMS	07:20	10:47	08:38	13:23

There has been a growth in total response time over the last several years. The average and 90th percentile total response times steadily increased from 2003 (08:46 and 13:54, respectively) to 2007 (09:06 and 14:14, respectively). Table 15 shows the increases of nearly two percent in the average and nearly three in the 90th percentile for 2003 through 2007. The increase in total response time can be attributed in part to the increasing call volume.

Table 15: Total Response Times by Year

Year	Number of Valid Responses	Average	90th Percentile
2003	128,262	08:46	13:54
2004	123,529	08:47	13:53
2005	126,275	08:54	13:59
2006	131,824	09:06	14:04
2007	135,647	09:06	14:14

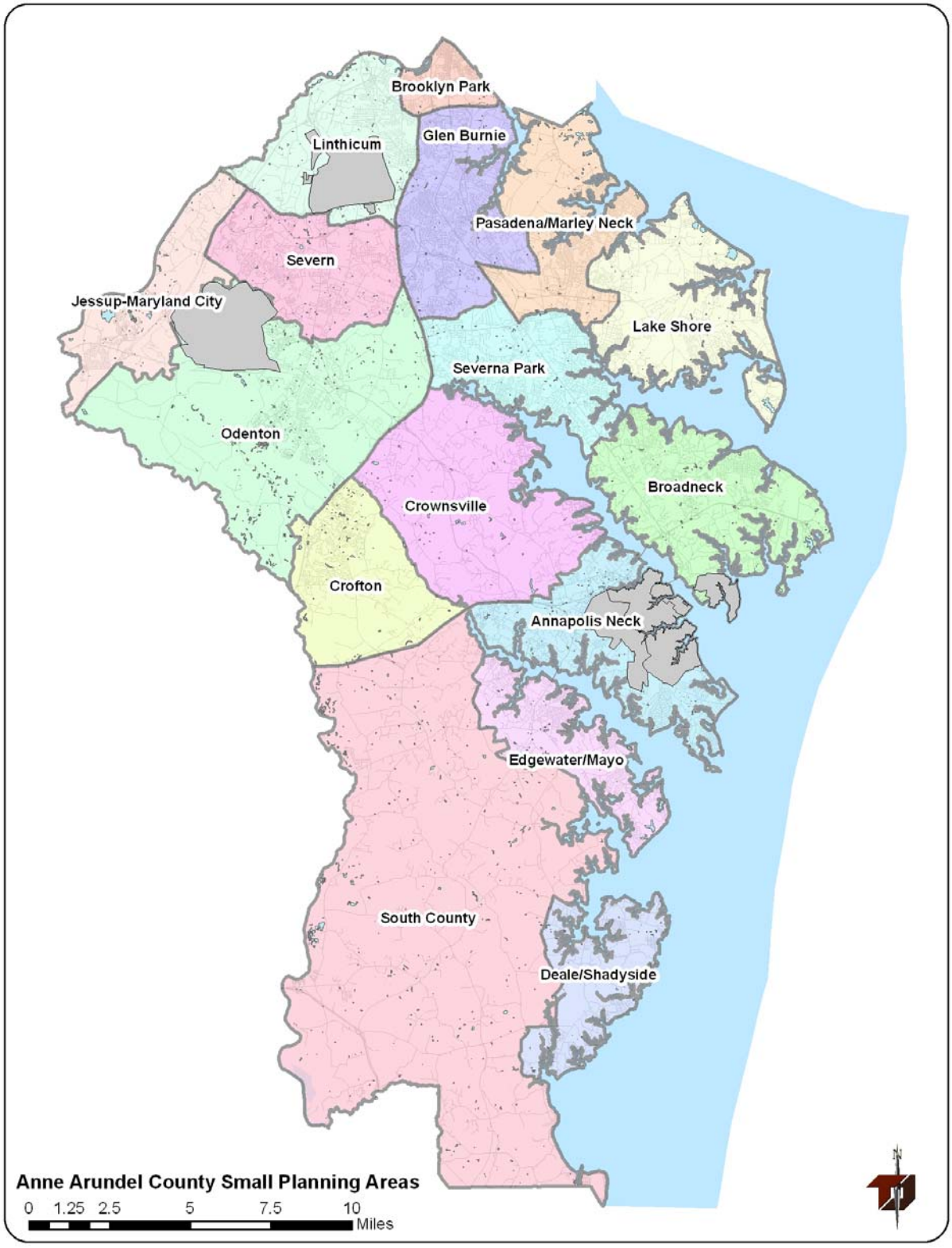
Station Location Analysis

This section examines station coverage and allocation of apparatus. The primary objective is to determine what areas, if any, are in need of additional resources and how existing resources can be distributed to serve the county more efficiently and accommodate the increasing demand for services. The section begins with a review of the current demand patterns. This is followed by a discussion of response coverage and resource needs by small planning area, with alternate deployment options presented. Each planning area has primary and support stations. Primary stations are those that are located within the planning area. Support stations are the three most strategically located stations for that planning area.

Maps are included to show theoretical travel time reach for the current station and apparatus locations as well as the proposed changes. Travel time reach often is calculated based on the distance to calls (more precisely, length of GIS road centerline segments) and the posted speed limits. However, because of the unique geography and land area in Anne Arundel County, travel speeds were not assumed to be the posted speed limit. Instead, actual travel time from the CAD data was used to calculate average travel speeds, accounting for topography, narrow roads, congestion, and other limiting factors. This should yield a more realistic portrait of response

coverage. Map 2 provides an overview of the county's small planning areas, which have been used to organize the analysis results in this section as described in earlier chapters. The gray areas represent excluded areas of this analysis served by other fire departments, including the City of Annapolis (Stations 35, 36, and 38), Ft. Meade (Station 45), BWI Airport (Station 43), and the U.S. Naval Academy (Station 46).

Map 2: Anne Arundel County Small Planning Areas



Demand – The highest concentration of incidents are occurring in the northern portion of the county, especially in Glen Burnie, Broadneck, BWI-Linthicum, and Pasadena/Marley Neck. Smaller hotspots exist in the other planning areas, mainly around the more populated areas as expected. Table 16 shows the number of total emergency incidents and relative percent by small planning area for 2003 through 2007 as identified in CAD.

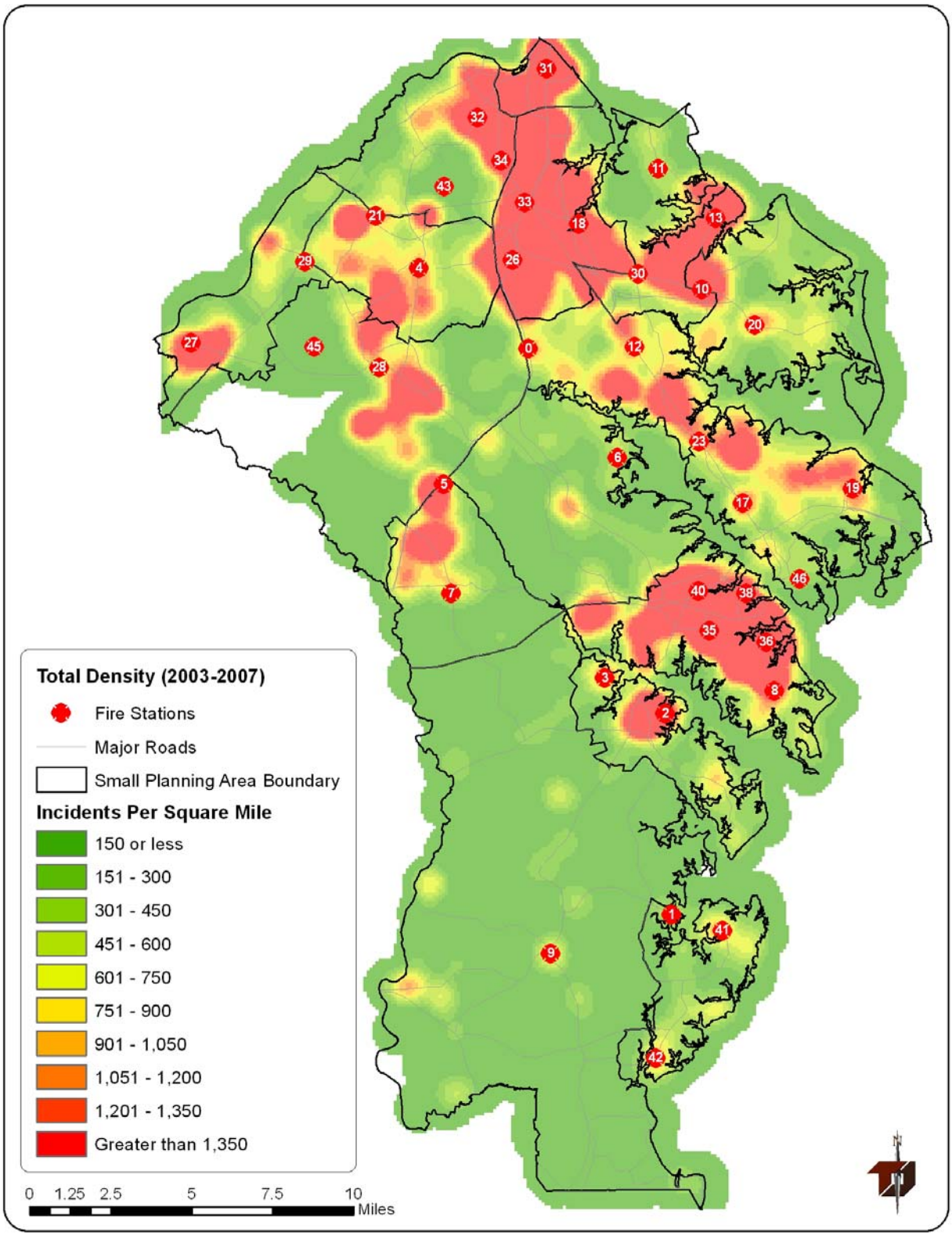
Table 16: Total Emergency Incidents by Small Planning Area, 2003–2007

Station	Number of Incidents (2003–2007)	Small Planning Area	Number of Incidents by Small Planning Area	Percent of Total Incidents
40	45933	Annapolis Neck	45933	7%
17	24461	Broadneck	56449	8%
19	15016			
23	16972			
31	35756	Brooklyn Park	35756	5%
5	28552	Crofton	47537	7%
7	18985			
6	7659	Crownsville	7659	1%
1	8365	Deale/Shadyside	24705	4%
41	6098			
42	10242			
2	18931	Edgewater/Mayo	44945	7%
3	26014			
18	33503	Glen Burnie	127720	19%
26	47601			
33	46616			
27	15047	Jessup-Maryland City	37046	5%
29	21999			
10	21516	Lake Shore	34334	5%
20	12818			
32	27028	BWI/Linthicum	51791	8%
34	24763			
28	31011	Odenton	31011	5%
11	9701	Pasadena/Marley Neck	62137	9%
13	27486			
30	24950			
4	10690	Severn	33033	5%
21	22313			
12	31063	Severna Park	31063	5%
9	14311	South County	14311	2%

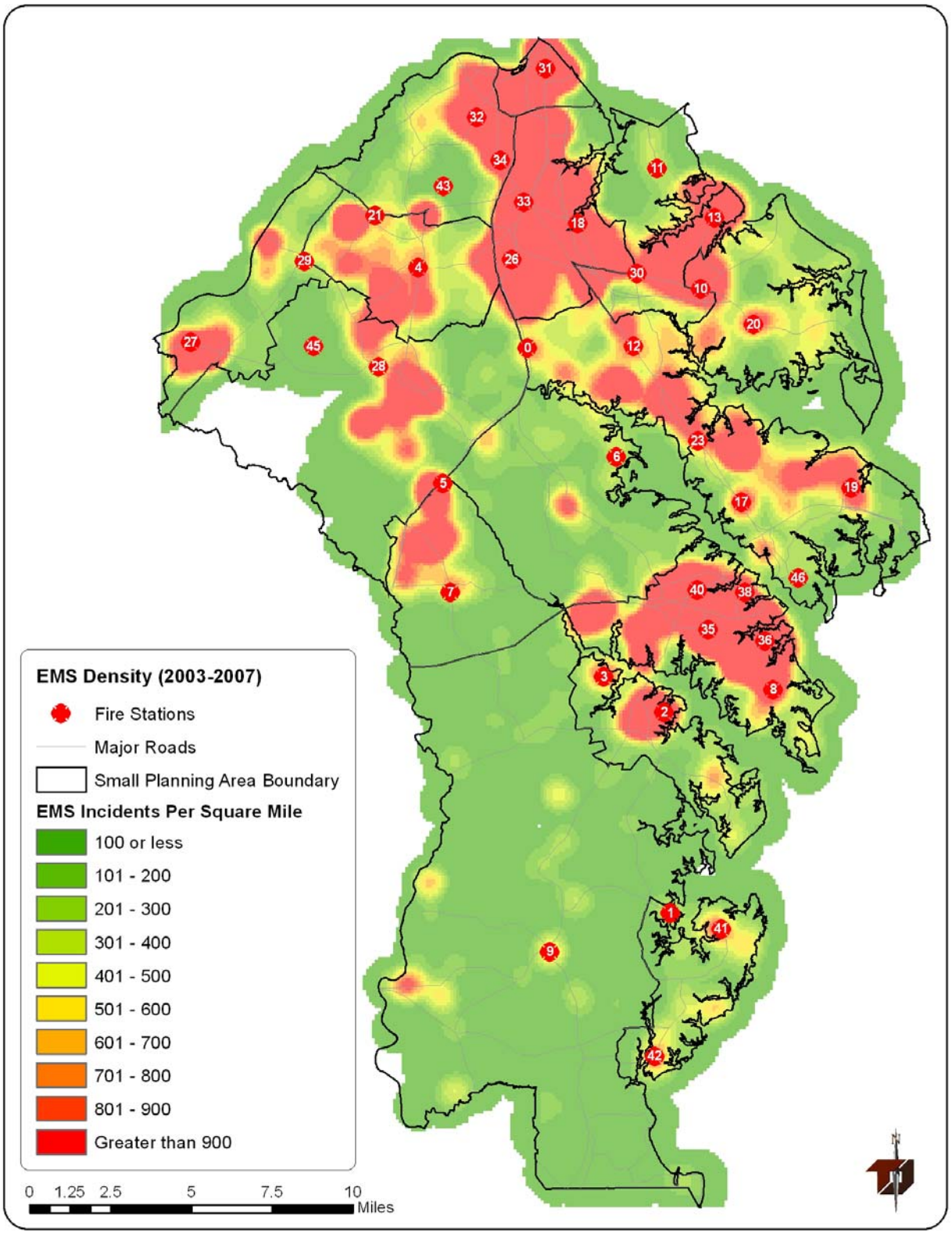
Map 3 through Map 6 show the 2003 through 2007 incident density for overall, EMS, fire, and rescue incidents. These maps were developed from the geocoded CAD data.[13] As described previously, the high incident density areas are in the northern portion of the County across all disciplines—EMS, fire, and rescue. Almost all of the small planning areas have at least one hotspot area, with several planning areas having multiple hotspot areas. Glen Burnie has the highest incident density and South County has the lowest.

[13] The CAD data geocoded at 82%. The incident density assumes the non-geocoded incidents are distributed somewhat evenly across the study area.

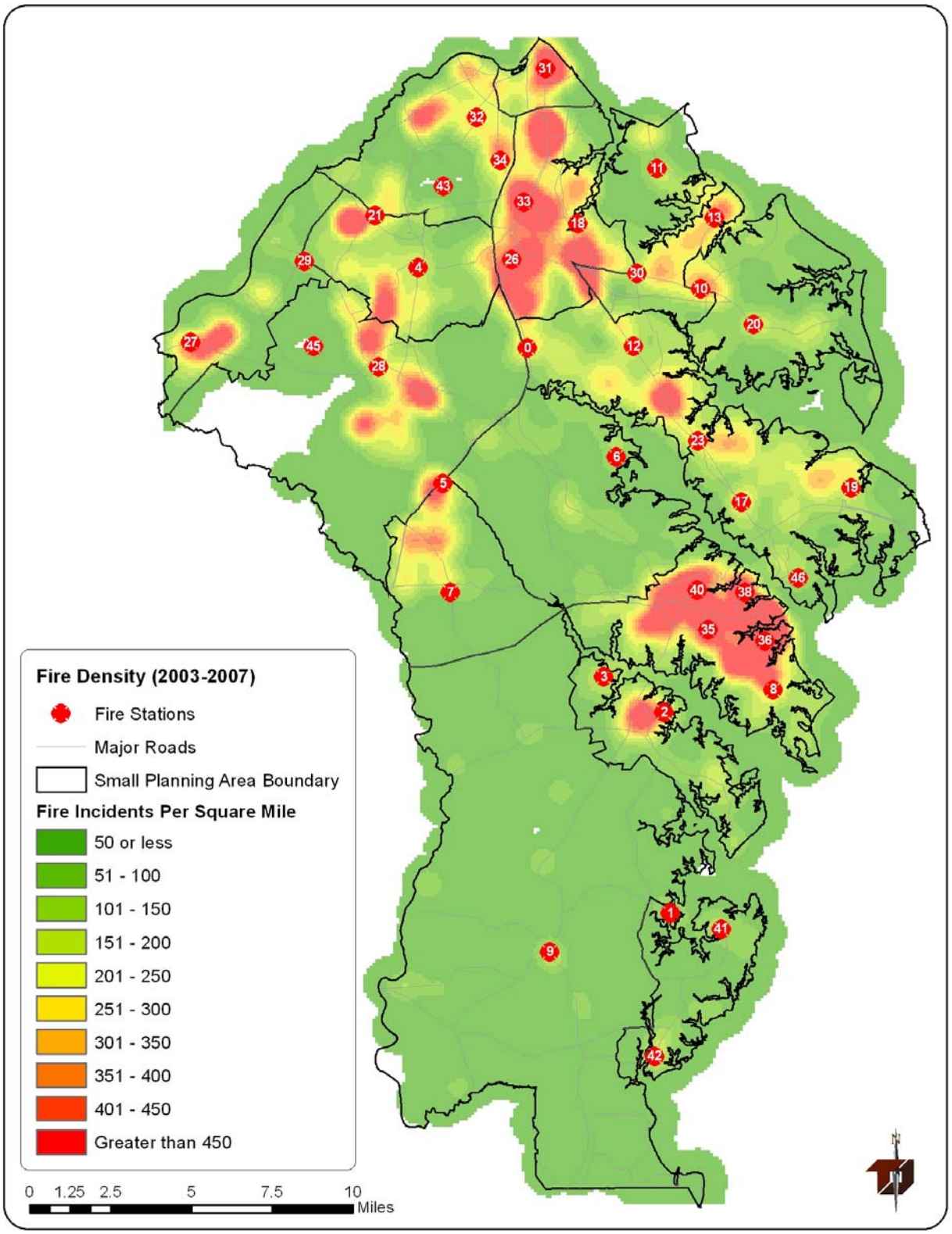
Map 3: Total Incident Density, 2003–2007



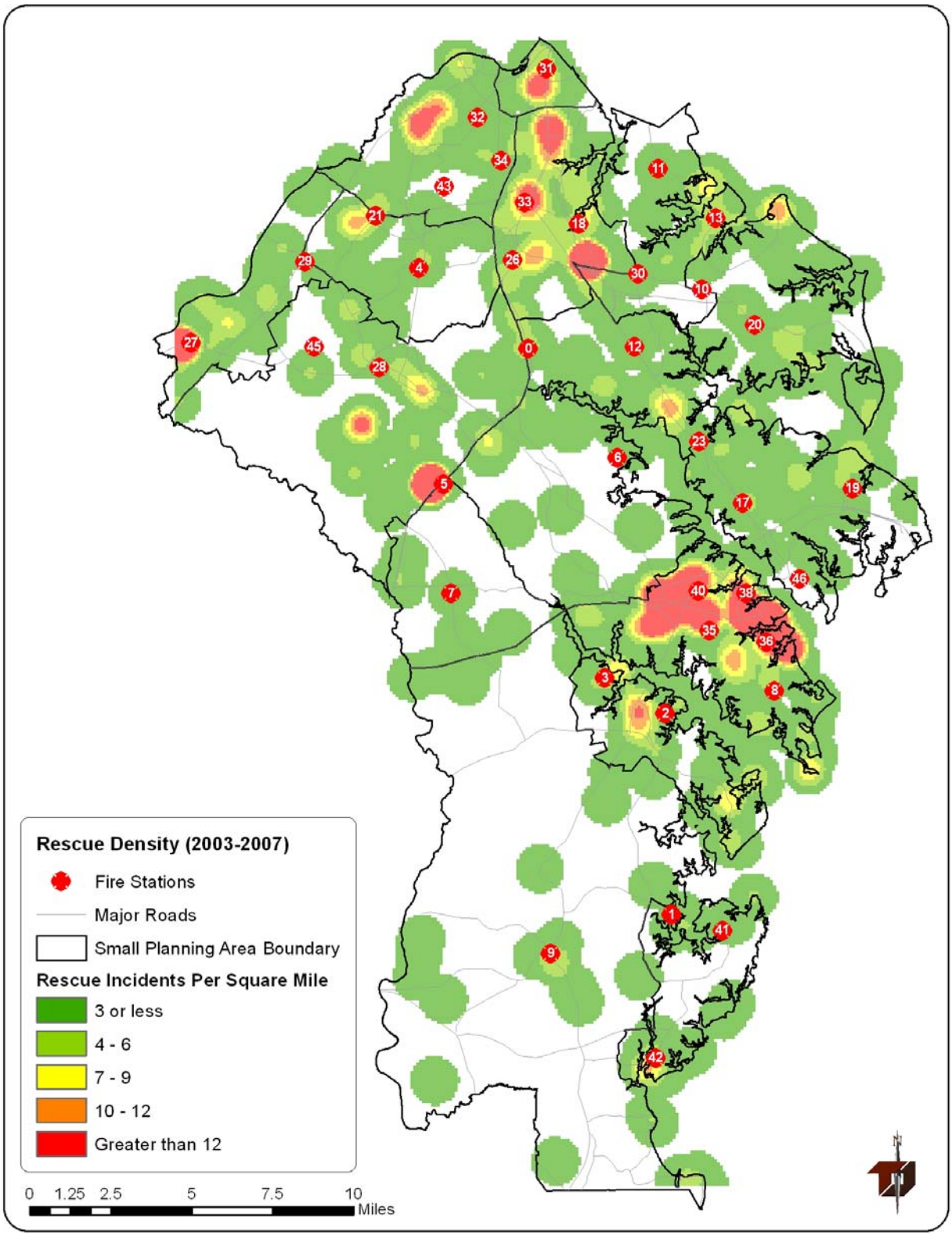
Map 4: EMS Incident Density, 2003–2007



Map 5: Fire Incident Density, 2003–2007



Map 6: Rescue Incident Density, 2003–2007



Also of importance is the distribution of severe incident types. Specifically, cardiac arrests and structure fires are considered among the most serious EMS and fire incident types, respectively, and are generally handled as the highest priorities. Table 17 shows the number of structure fires and cardiac arrests occurring in each planning area in 2007. Cardiac arrest data is retrieved from CAD and structure fire data is retrieved from NFIRS. The highest number of both structure fires and cardiac arrests occurred in Glen Burnie for 2007. Severn, Broadneck, and Pasadena/Marley Neck areas had the next highest number of structure fires and Severna Park, Pasadena/Marley Neck, and Brooklyn Park had the next highest number of cardiac arrests. These statistics are in-line with the previous incident density analysis (Map 3 through Map 6).

Table 17: Structure Fires and Cardiac Arrests by Small Planning Area

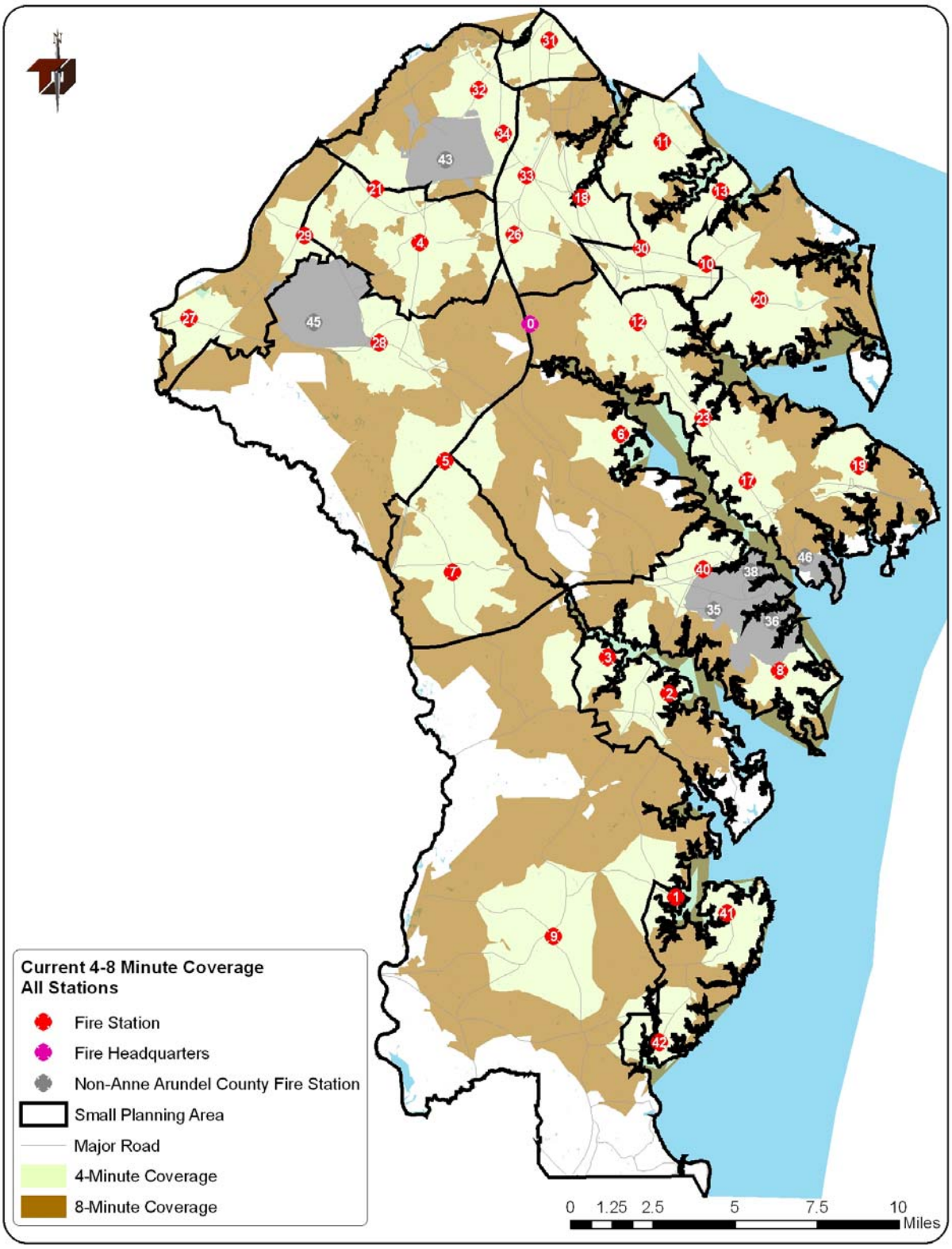
	Structure Fires		Cardiac Arrests	
Small Planning Area	**Number**	**Percent**	**Number**	**Percent**
Annapolis Neck	12	2.6	34	5.7
Broadneck	41	8.9	41	6.9
Brooklyn Park	24	5.2	42	7.0
BWI/Linthicum	16	3.5	36	6.0
Crofton	17	3.7	15	2.5
Crownsville	15	3.2	18	3.0
Deale/Shadyside	7	1.5	8	1.3
Edgewater/Mayo	26	5.6	25	4.2
Glen Burnie	78	16.8	141	23.6
Jessup-Maryland City	26	5.6	17	2.8
Lake Shore	32	6.9	35	5.9
Odenton	35	7.6	39	6.5
Pasadena/Marley Neck	37	8.0	43	7.2
Severn	53	11.4	35	5.9
Severna Park	24	5.2	46	7.7
South County	20	4.3	22	3.7
Total	**463**	**100**	**597**	**100**

Station Location Analysis

This section of the report discusses station location analysis by small planning area and examines the individual characteristics of each of the sixteen small planning areas. This analysis includes station and apparatus location. Map 7 shows the current 4 and 8 minute theoretical coverage for the entire county. A current and proposed (if applicable) coverage map is shown for each small planning area. Four-minute coverage is shown for each primary station and eight-minute coverage for each support station, as this provides a picture for optimal coverage. Incident coverage maps are also shown for each planning area to give a historical look at

incidents covered within four, six, and eight minutes. The incident coverage maps are based off of the geocoded CAD data for 2003 through 2007. Additional coverage maps were considered and are included in the appendix showing four and eight minute coverage for all small-planning areas.

Map 7: Anne Arundel County Current 4 and 8-Minute Coverage



Annapolis Neck – The City of Annapolis and a portion of the U.S. Naval Academy are located in this area and are excluded from the majority of this analysis. The City of Annapolis' station 35 has one Anne Arundel County tanker located at its station which will be included where appropriate. Annapolis Neck has two primary fire stations located within its limits—stations 8 and 40. Station 8 is a new station; however, it will be used in this analysis as it is slated to open in the near future. Stations 2, 3, and 17 provide service to this area and are considered support stations. Mutual aid is provided by the City of Annapolis (stations 35, 36, and 38) and the U.S. Naval Academy station 46. Table 18 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count.14 Map 8 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 18: Annapolis Neck Fire Stations

Station	Personnel	Primary Apparatus [15]	2003–2007 Emergency Response Count
40	41 career, 27 volunteer	Engine (Co) Engine (Vo) Medic (Co) Tanker (Vo) Truck/Tower (Co)	45,933

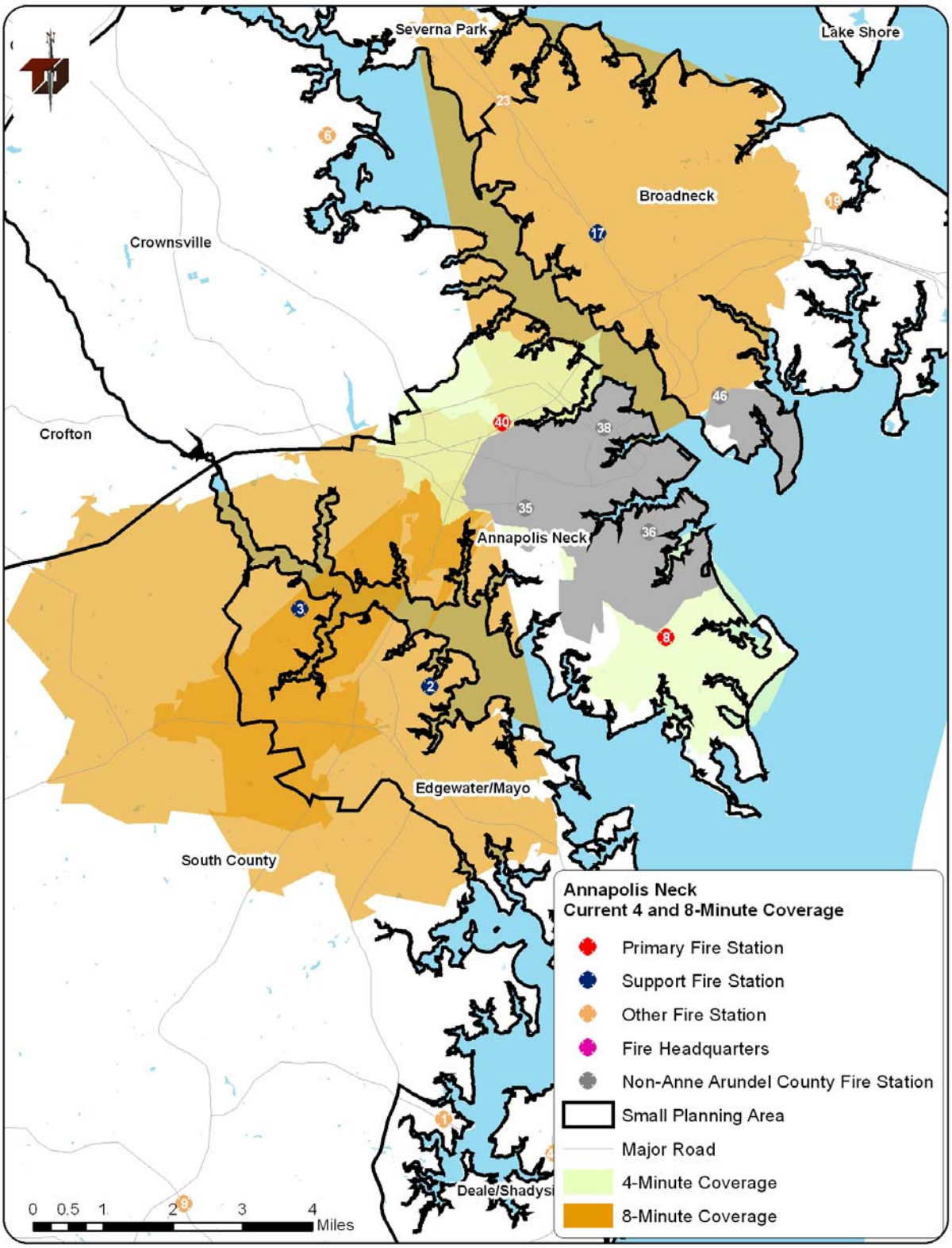
The 2003–2007 emergency response count for station 40 was 45,933. Of those responses, 71.1 percent were EMS incidents, 27.7 percent were fire incidents, and 1.1 percent rescue incidents. When examining travel time reach in the Annapolis Neck area regardless of responding station, 69 percent of EMS incidents, 64 percent of fire incidents, and 58 percent of rescue incidents were located within a four minute travel time of existing stations; 99 percent of EMS incidents and 100 percent of fire and rescue incidents were located within an eight minute travel time of existing stations.[16] Map 9, titled "Current Annapolis Neck Incident Coverage," represents the percentage of incidents covered at four, six, and eight minutes using current station locations for 2003 through 2007 incidents. Overall, travel times within the Annapolis Neck small planning area averaged 4 minutes 22 seconds with a 90th percentile measure of 7 minutes 54 seconds.

[14] All response count data is extracted from the CAD for the years 2003-2007 as provided by Anne Arundel County Fire and Rescue in February 2008. A response is counted for each responding apparatus from a particular station. For example, if an engine and ambulance both respond from a station for a single emergency incident, this is counted as 2 responses for that station.

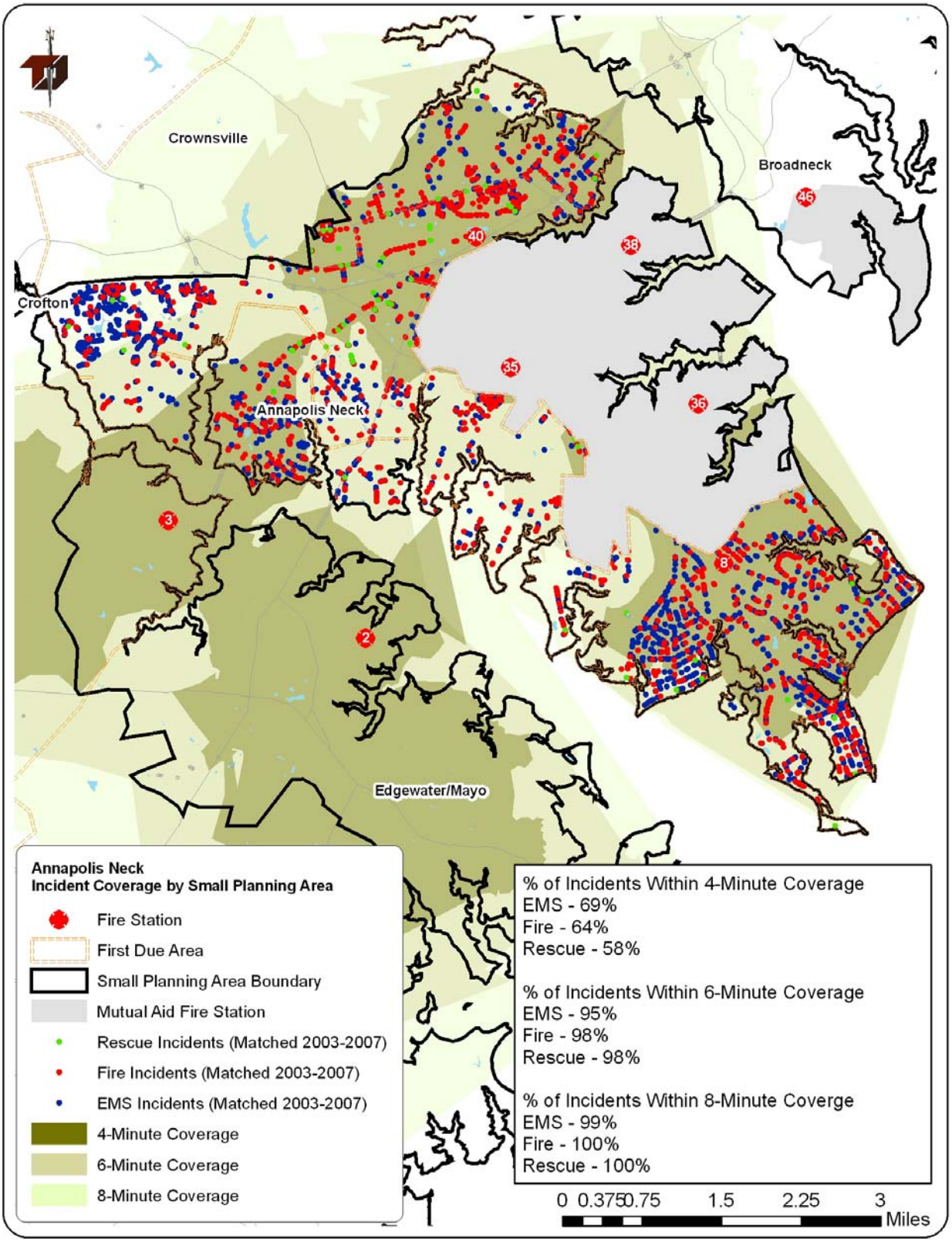
[15] Co = County owned, Vo = Volunteer owned

[16] Incident coverage percentages are stated in relation to the number of geocoded incidents with a match rate of 82% as described previously in the demand section.

Map 8: Current Annapolis Neck Coverage



Map 9: Current Annapolis Neck Incident Coverage



The new station 8 fills the gap in coverage on the east end of Annapolis Neck. The station is well-located and, in conjunction with existing station 40, provides good coverage for the area. Placing a paramedic engine and medic unit at station 8 is recommended to provide ample coverage for the types of incidents in the area. The coverage and incident coverage maps remain the same with this recommendation.

Recommendation 1: Place a paramedic engine and medic unit at the new station 8.

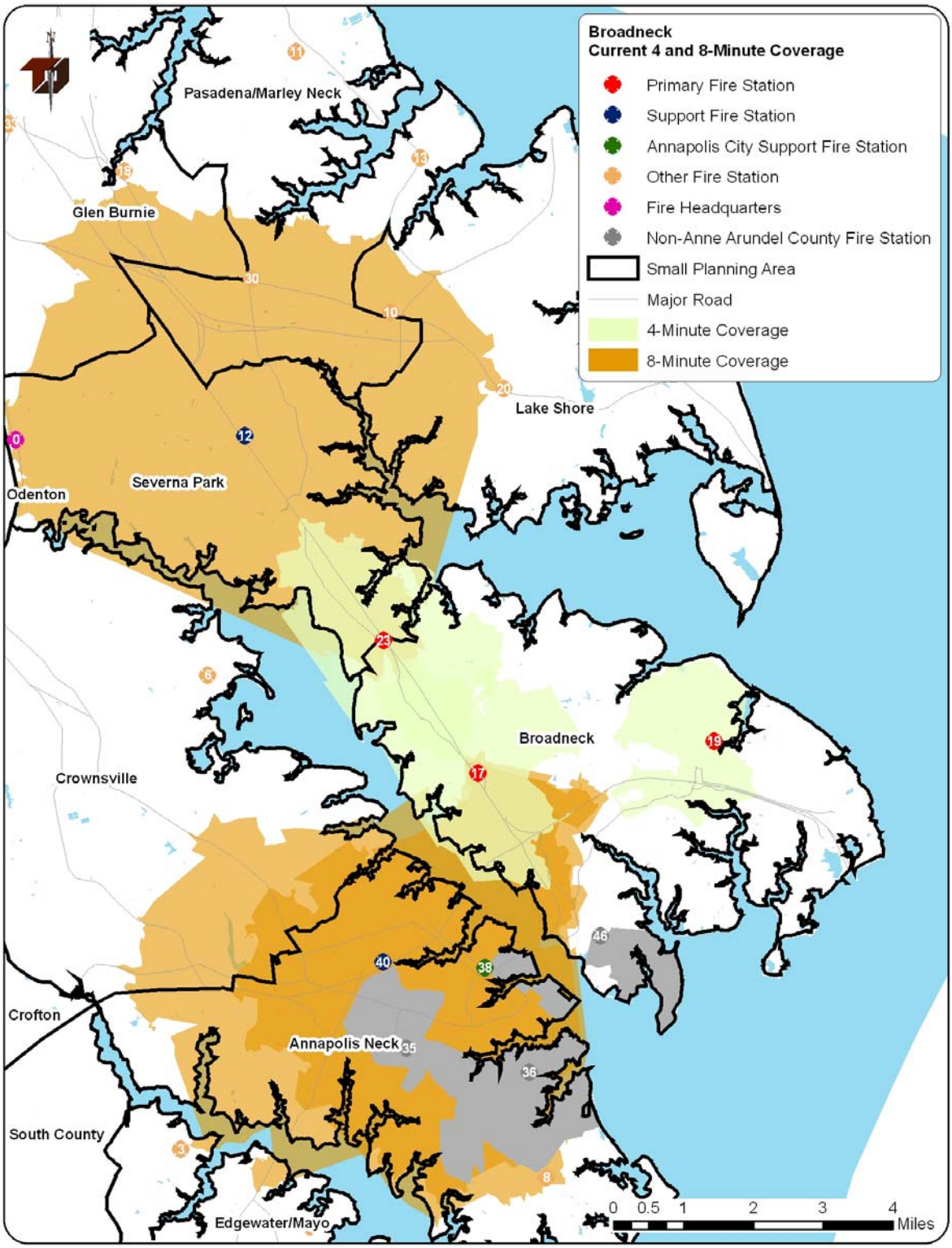
Broadneck – A portion of the U.S. Naval Academy is located in this area and is excluded from the majority of this analysis. Broadneck has three primary fire stations located within its limits – stations 17, 19, and 23. Stations 12, 38 (City of Annapolis), and 40 provide service to this area and are considered support stations. Mutual aid is provided by U.S. Naval Academy station 46. Table 19 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 10 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 19: Broadneck Fire Stations

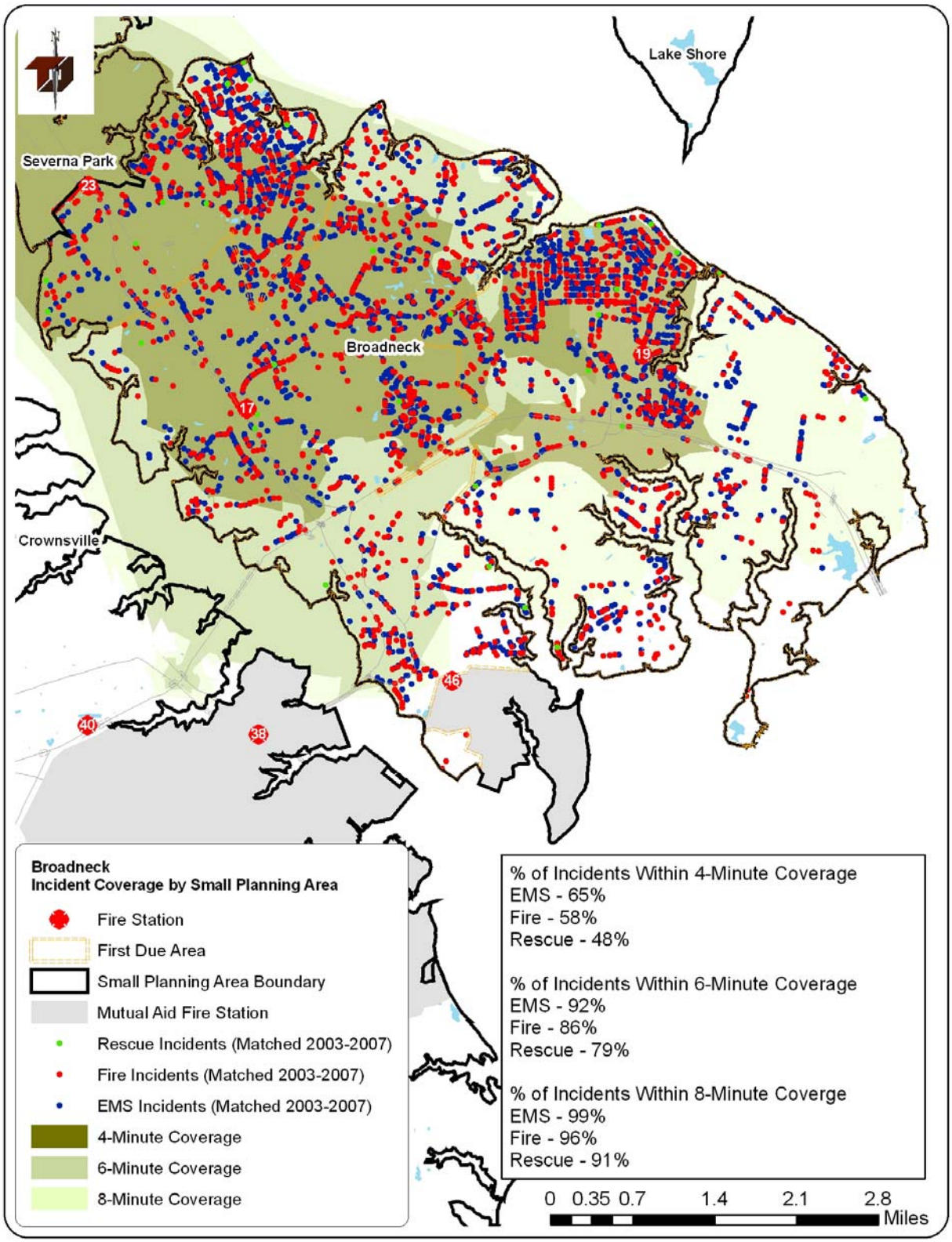
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
17	28 career, 20 volunteer	Engine (Co) Engine (Vo) Paramedic (Co)	24,461
19	16 career, 19 volunteer	Ambulance (Co) 2 Engines (Vo)	15,016
23	32 career, 0 volunteer	Quint (Co) Squad/Dive/Special Ops (Co)	16,972

The 2003–2007 emergency response count for the three fire stations (17, 19, and 23) was 56,449. Of those responses, 71.6 percent were EMS incidents, 25.8 percent were fire incidents, and 2.6 percent rescue incidents. When examining travel time reach in the Broadneck area regardless of responding station, 65 percent of EMS incidents, 58 percent of fire incidents, and 48 percent of rescue incidents were located within a four minute travel time of existing stations; 99 percent of EMS incidents, 96 percent of fire incidents, and 91 percent of rescue incidents were located within eight minute travel time of existing stations. Map 11 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Broadneck small planning area averaged 3 minutes 45 seconds with a 90th percentile measure of 6 minutes 13 seconds.

Map 10: Current Broadneck Coverage



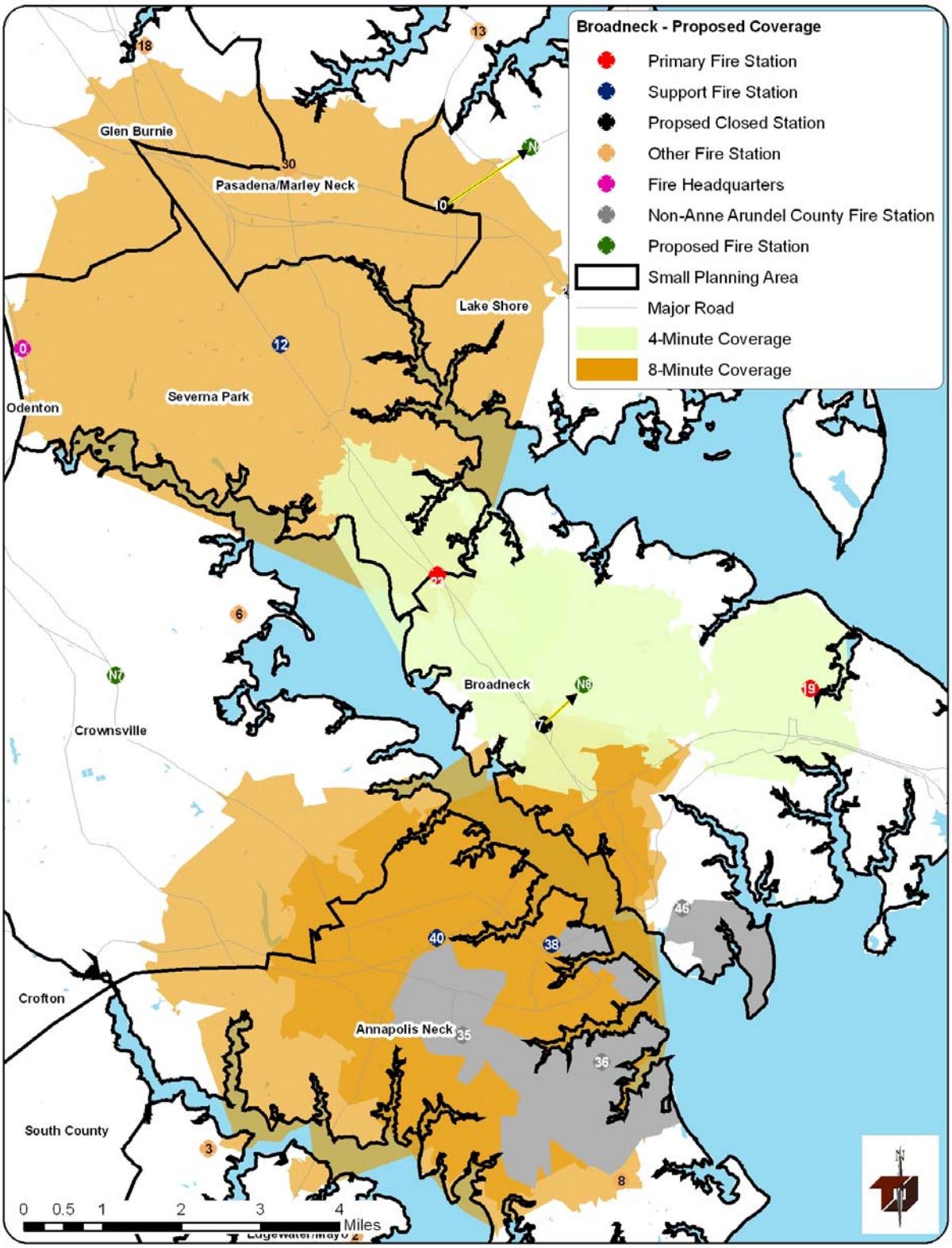
Map 11: Current Broadneck Incident Coverage



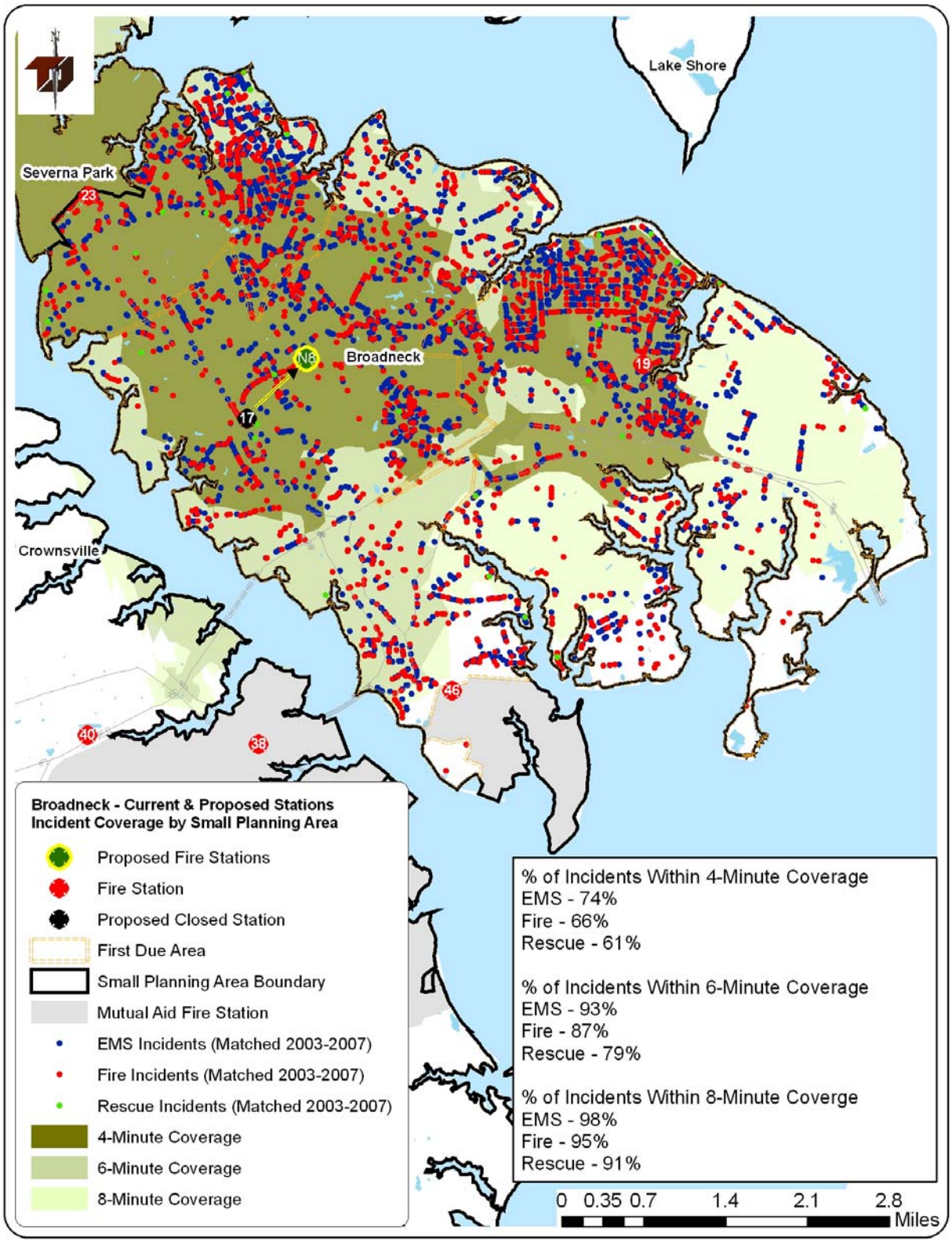
The current coverage in Broadneck provides moderate overlap among two of the three stations (23 and 17) four minute coverage and also with Annapolis Neck station 40's eight minute coverage. Currently just over half of EMS and fire incidents are covered within four minutes in Broadneck. As shown in Map 13, by moving station 17 to the east near the intersection of Jones Station Road and Church Road, four minute incident coverage would increase by approximately ten percent.

Recommendation 2 (Low Priority): Relocate station 17 near the intersection of Jones Station Road and Church Road (N6). Station 17 is outdated and not currently in an optimal location.

Map 12: Proposed Broadneck Coverage



Map 13: Proposed Broadneck Incident Coverage



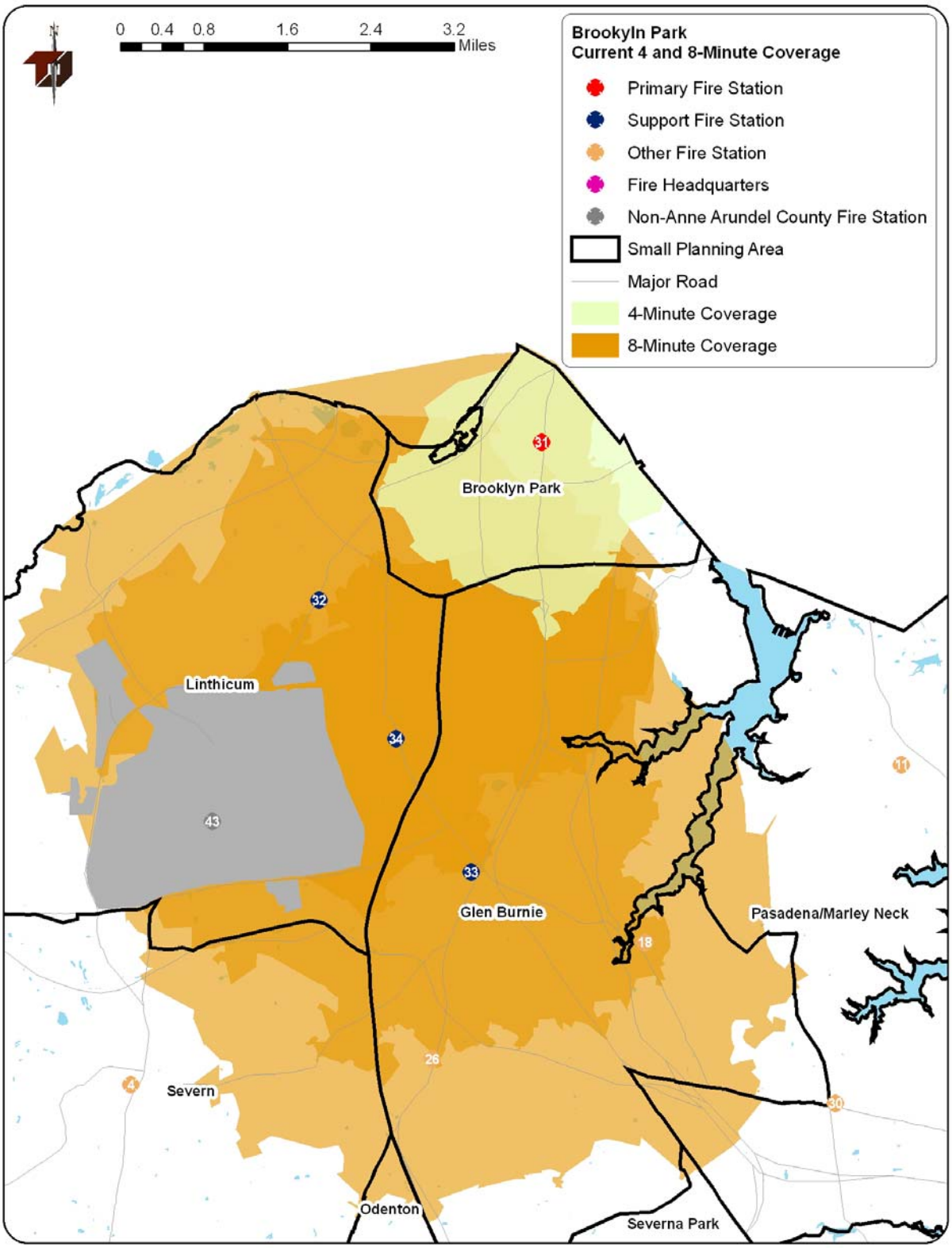
Brooklyn Park – Brooklyn Park has one primary fire station located within its limits—Station 31. Stations 32, 33, and 34 provide service to this area and are considered support stations. Mutual aid is provided by Baltimore City station 35. Table 20 shows the current apparatus and personnel assigned to the primary fire station with an emergency response count. Map 14 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for the primary station and eight minute theoretical coverage is shown for support stations.

Table 20: Brooklyn Park Fire Station

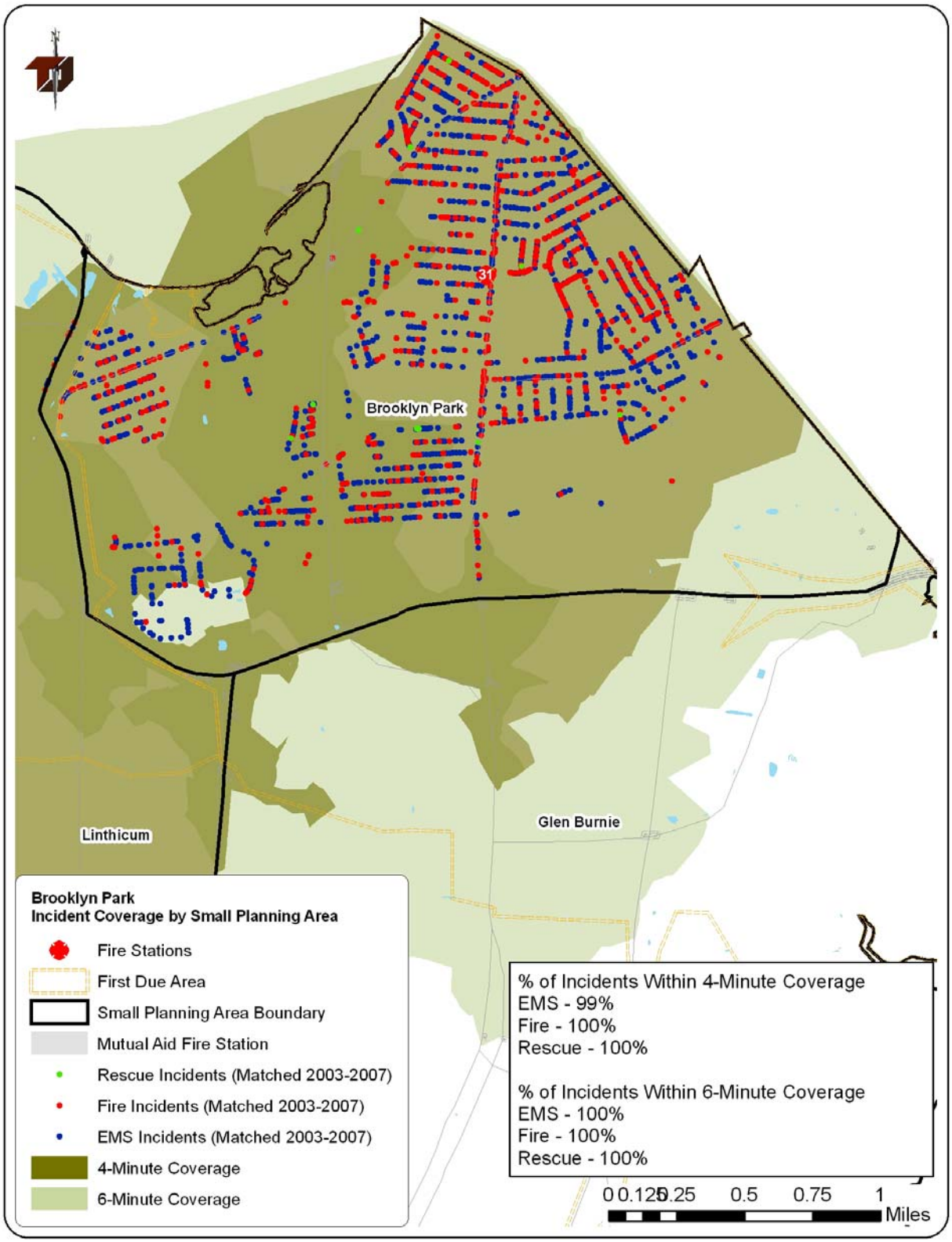
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
31	36 career, 0 volunteer	Engine (Co) Truck/Tower (Co) Paramedic (Co)	35,756

The 2003–2007 emergency response count for the station 31 was 35,756. Of those responses, 85.3 percent were EMS incidents, 14.1 percent were fire incidents, and 0.6 percent rescue incidents. When examining travel time reach in the Brooklyn Park area regardless of responding station, 99 percent of EMS incidents, 100 percent of fire incidents, and 100 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 15 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Brooklyn Park small planning area averaged 3 minutes 22 seconds with a 90th percentile measure of 5 minutes 21 seconds.

Map 14: Current Brooklyn Park Coverage

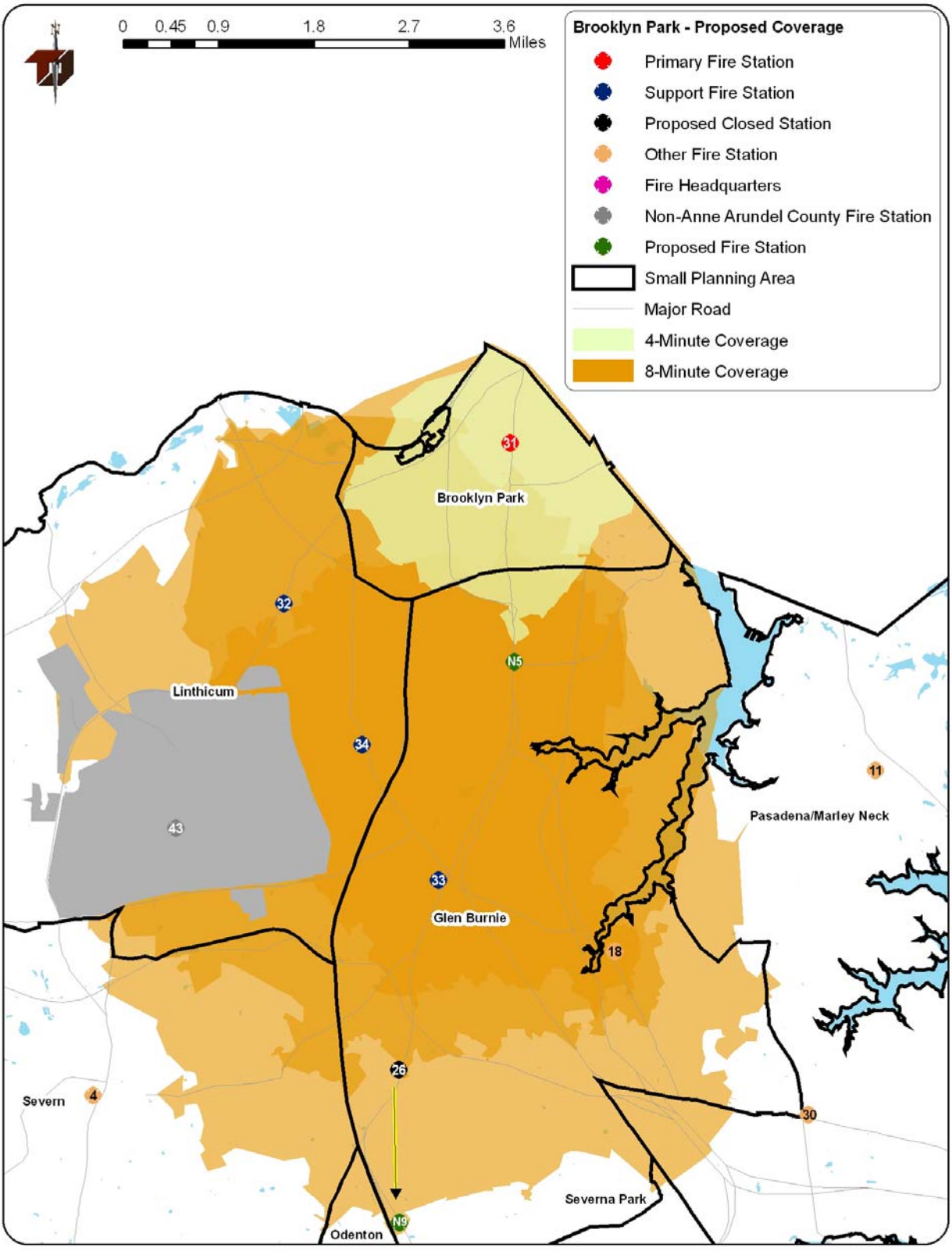


Map 15: Current Brooklyn Park Incident Coverage

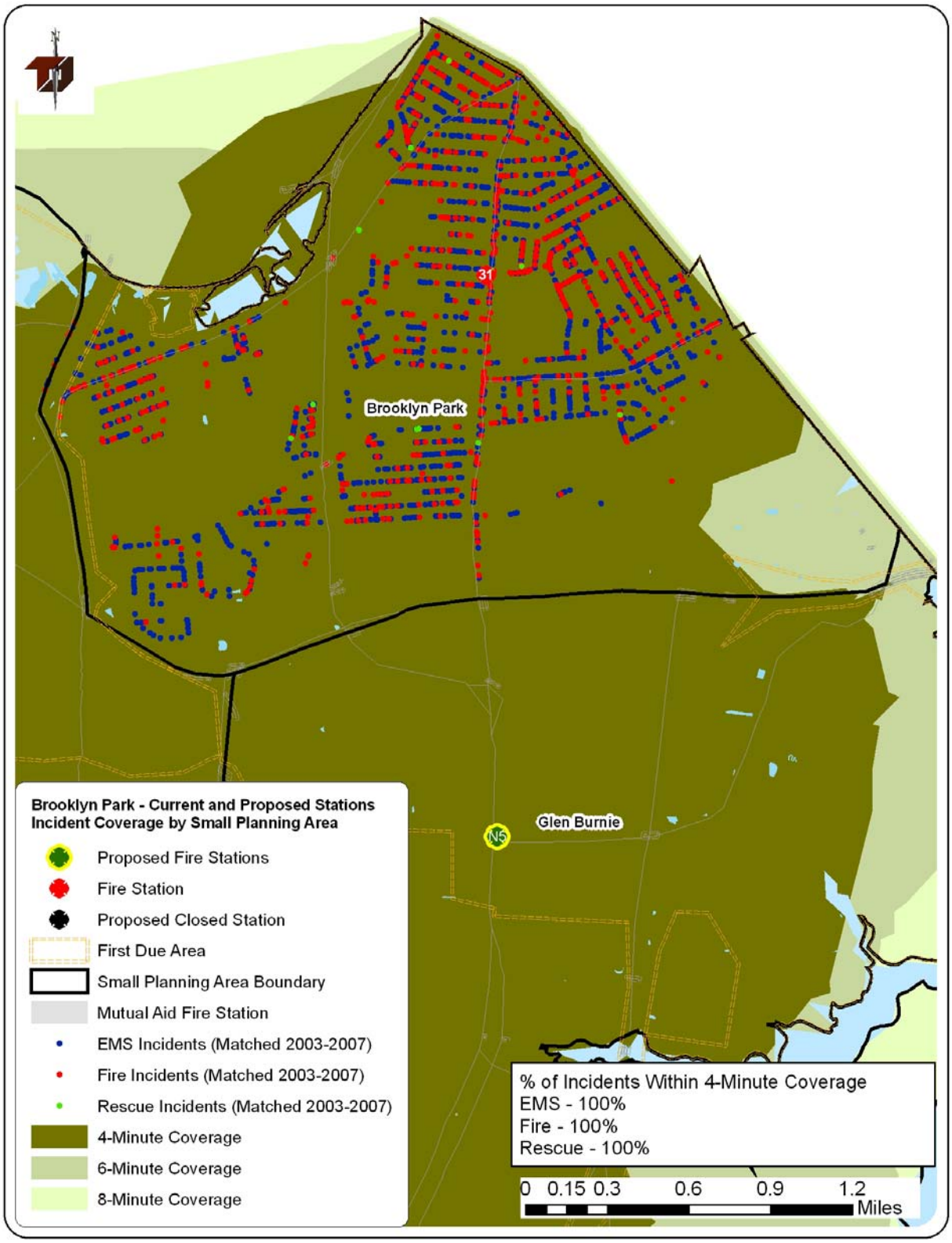


The Brooklyn Park incident coverage is excellent with nearly 100 percent of all geocoded incidents within the four minute coverage area. There is significant overlap among the support stations to Brooklyn Park, mainly station's 32, 33, and 34. However, due to the high incident density in this area, the coverage is warranted. Map 16 and Map 17 illustrate the proposed new coverage and proposed incident coverage. The proposed new station is "N5" is discussed in the Glen Burnie section.

Map 16: Proposed Brooklyn Park Coverage



Map 17: Proposed Brooklyn Park Incident Coverage



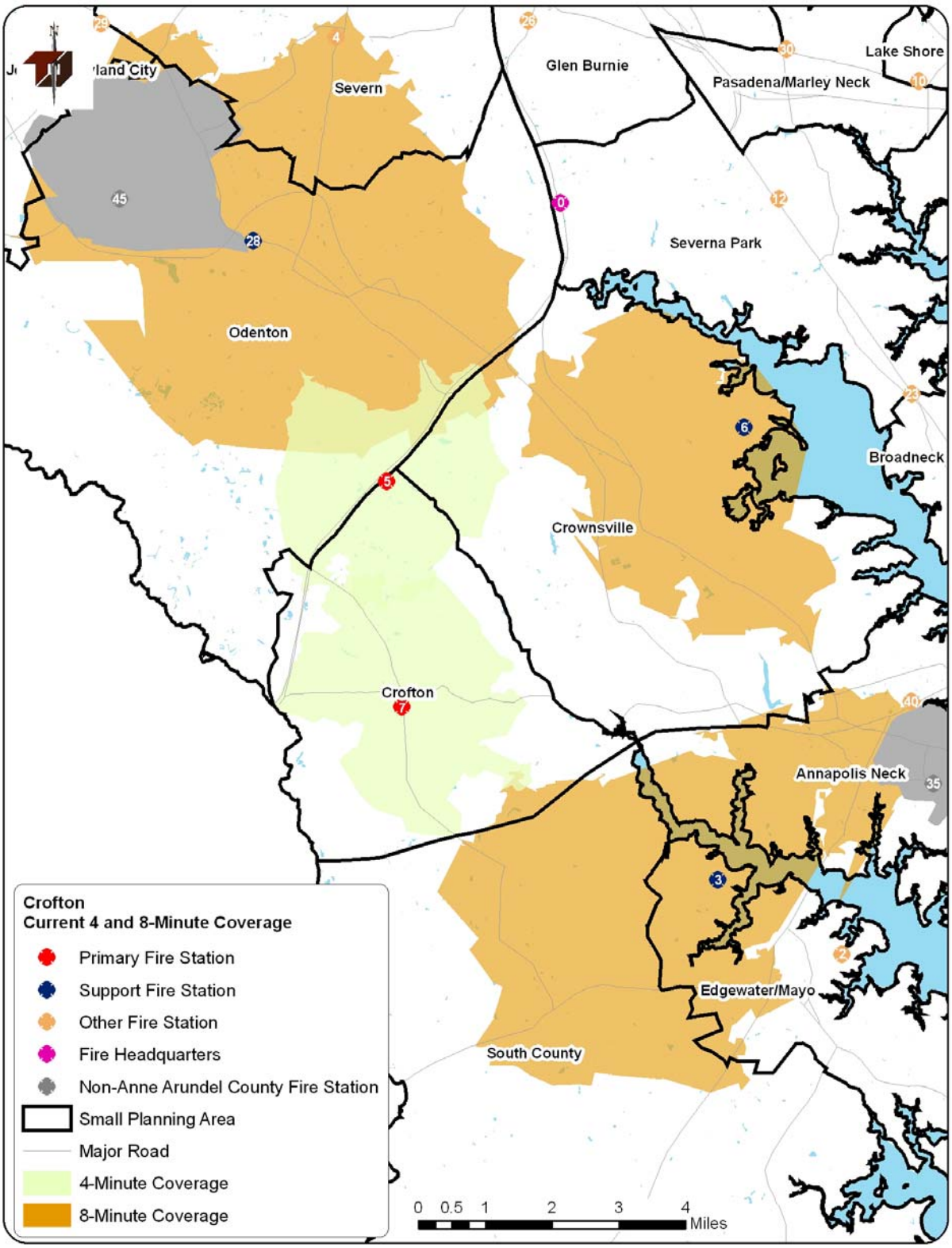
Crofton – Crofton has two primary fire stations located within its limits—Stations 5 and 7. Stations 3, 6, and 28 provide service to this area and are considered support stations. Mutual aid is provided by Prince George's County Station 39. Table 21 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 18 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 21: Crofton Fire Stations

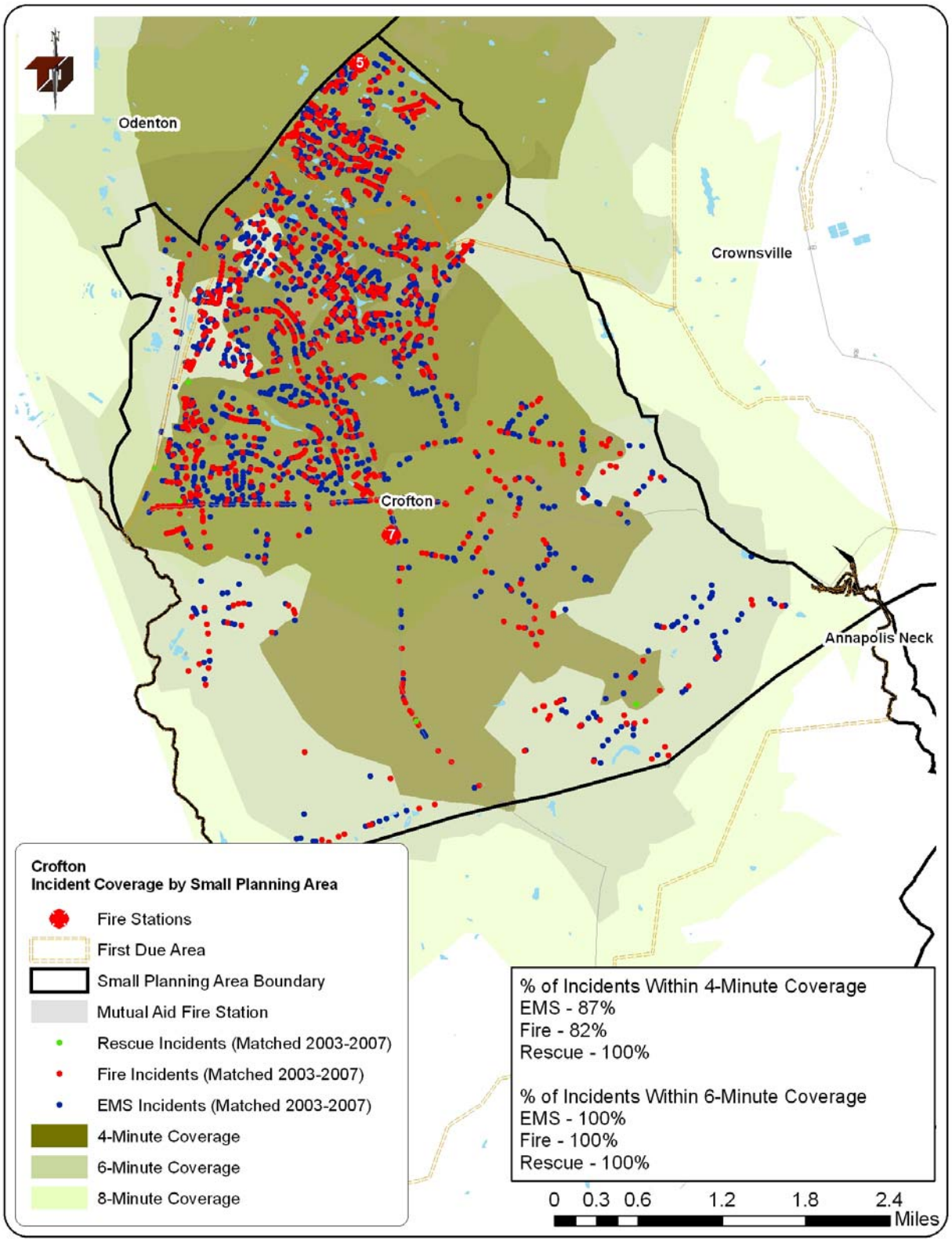
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
5	24 career, 0 volunteer	Engine (Co) Paramedic (Co)	28,552
7	16 career, 40 volunteer	Engine (Co) Engine (Vo) Ambulance (Co) Squad (Vo)	18,985

The 2003–2007 emergency response count for the two fire stations (5 and 7) was 47,537. Of those responses, 78.9 percent were EMS incidents, 20.1 percent were fire incidents, and 1.0 percent rescue incidents. When examining travel time reach in the Crofton area regardless of responding station, 87 percent of EMS incidents, 82 percent of fire incidents, and 100 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all types of incidents were located within an eight minute travel time of existing stations. Map 19 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Crofton small planning area averaged 3 minutes 57 seconds with a 90th percentile measure of 6 minutes 30 seconds.

Map 18: Current Crofton Coverage



Map 19: Current Crofton Incident Coverage



Stations 5 and 7 provide adequate coverage for Crofton. The location of station 7 is central to the small planning area and provides good four minute reach to the area. Station 7 is located on the northern edge of the planning area and covers much of Odenton and Crownsville in addition to Crofton. The incident volume is also high in this portion of Crofton; however, the relocation of station 6 (discussed in the Crownsville section) will provide closer support to this area resulting in increased coverage for concurrent incidents. The coverage and incident coverage maps remain the same for Crofton.

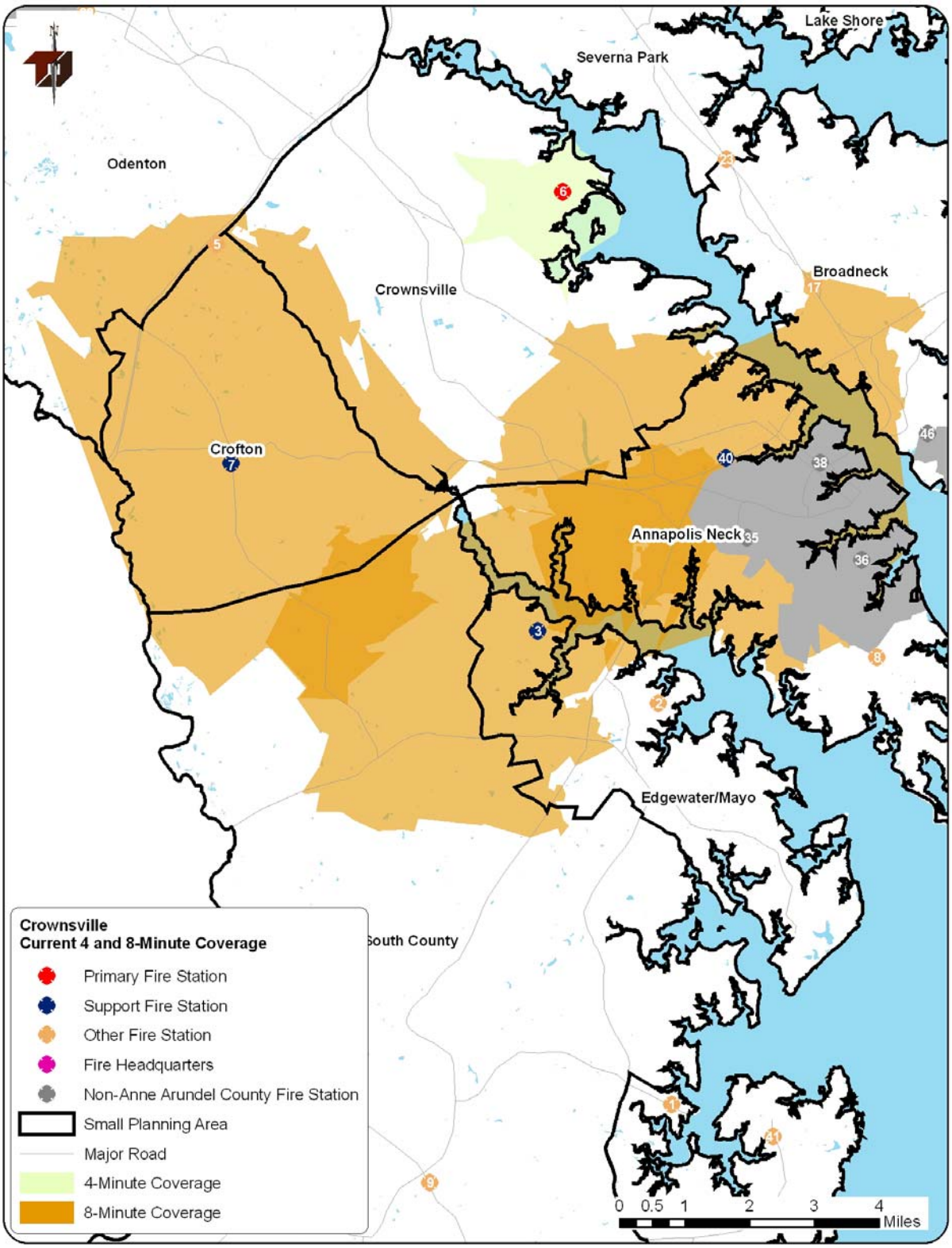
Crownsville – Crownsville has one primary fire station located within its limits—Station 6. Stations 3, 7, and 40 provide service to this area and are considered support stations. Table 22 shows the current apparatus and personnel assigned to the primary fire station with an emergency response count. Map 20 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for the primary station and eight minute theoretical coverage is shown for support stations.

Table 22: Crownsville Fire Station

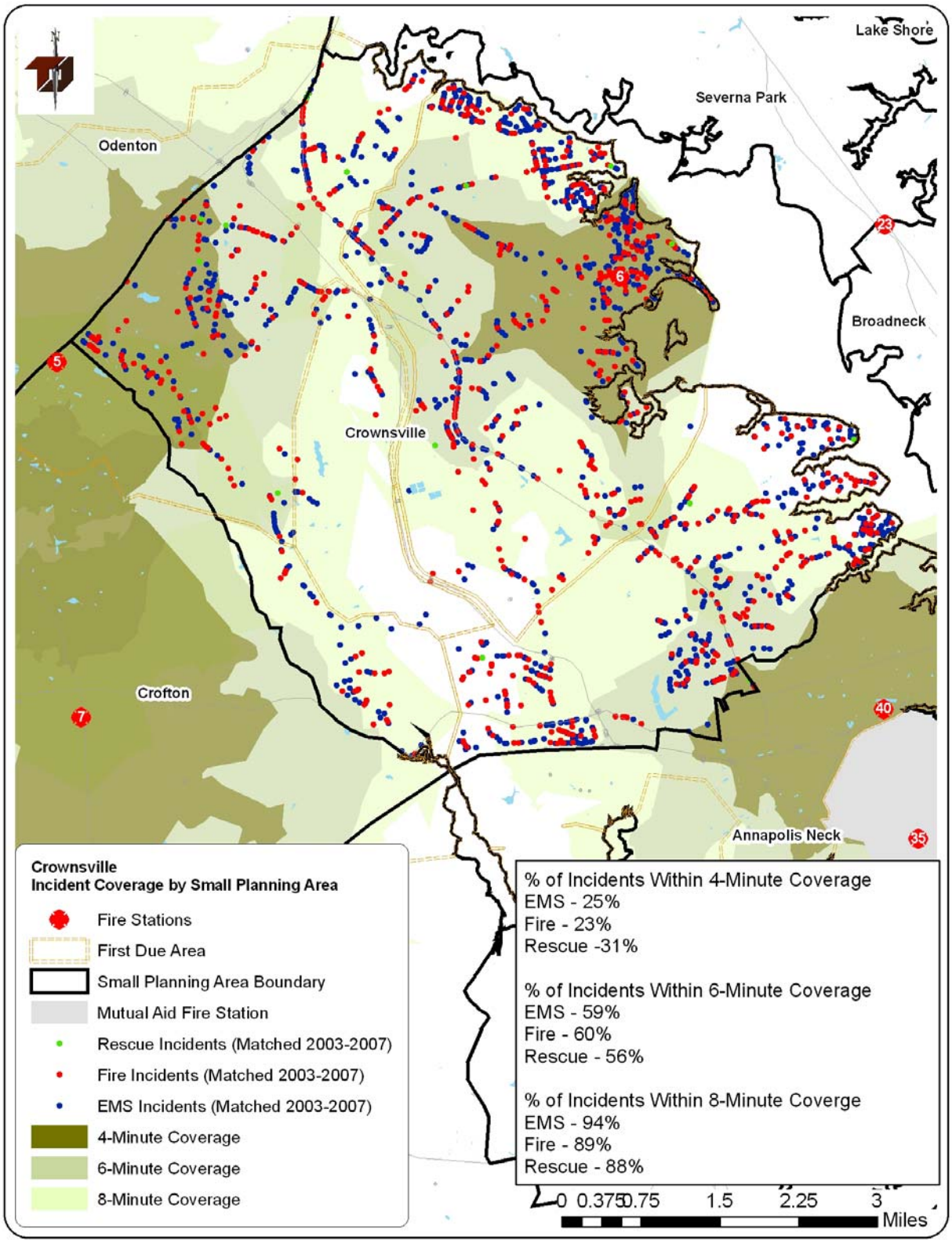
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
6	16 career, 19 volunteer	Pumper/Tanker (Co) Engine (Vo) Medic (Co)	7,659

The 2003–2007 emergency response count for station 6 was 7,659. Of those responses, 75.0 percent were EMS incidents, 22.6 percent were fire incidents, and 2.5 percent rescue incidents. When examining travel time reach in the Crownsville area regardless of responding station, 25 percent of EMS incidents, 23 percent of fire incidents, and 31 percent of rescue incidents were located within a four minute travel time of existing stations; 94 percent of EMS incidents, 89 percent of fire incidents, and 88 percent of rescue incidents were located within an eight minute travel time of existing stations. Map 21 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Crownsville small planning area averaged 5 minutes 39 seconds with a 90th percentile measure of 8 minutes 54 seconds.

Map 20: Current Crownsville Coverage



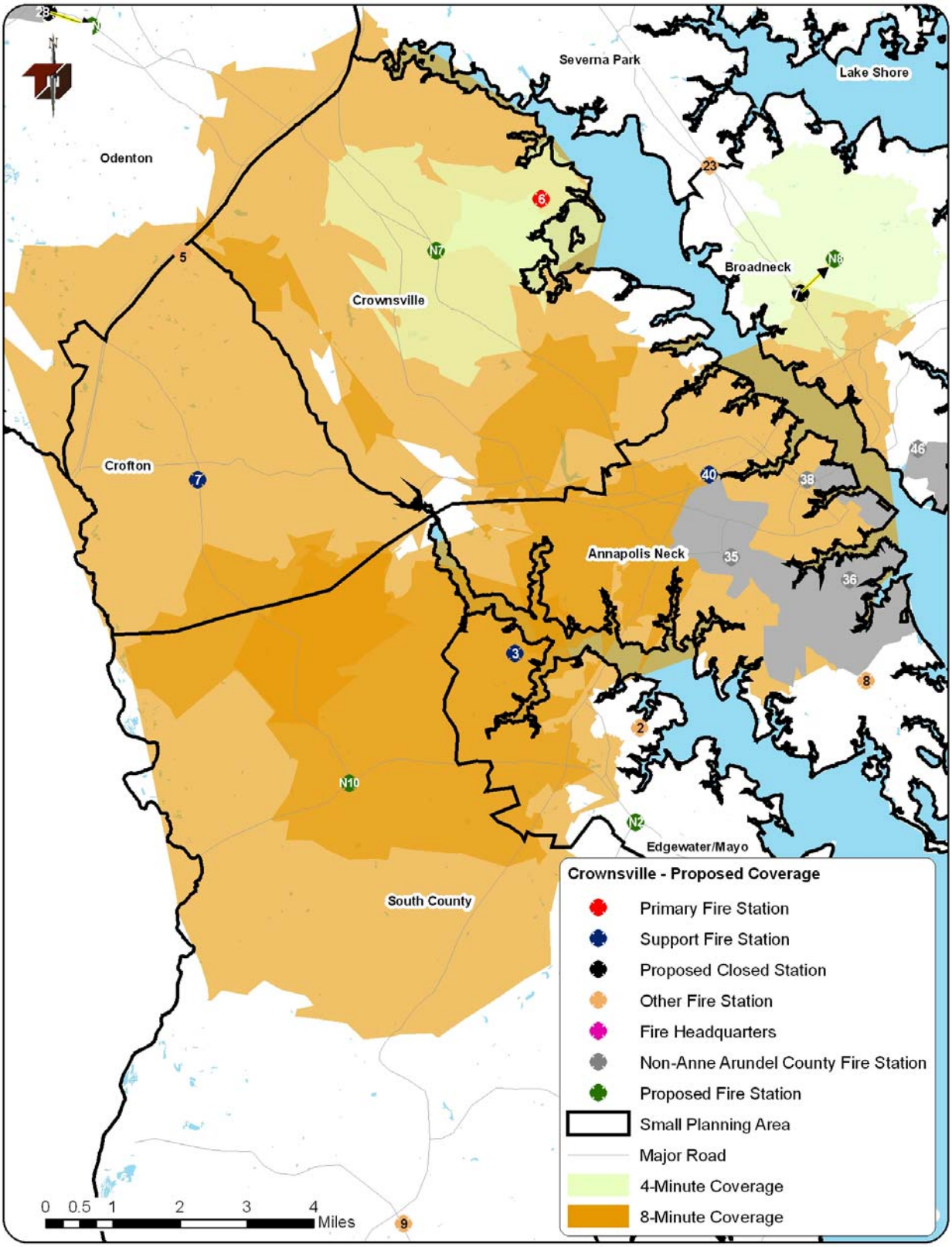
Map 21: Current Crownsville Incident Coverage



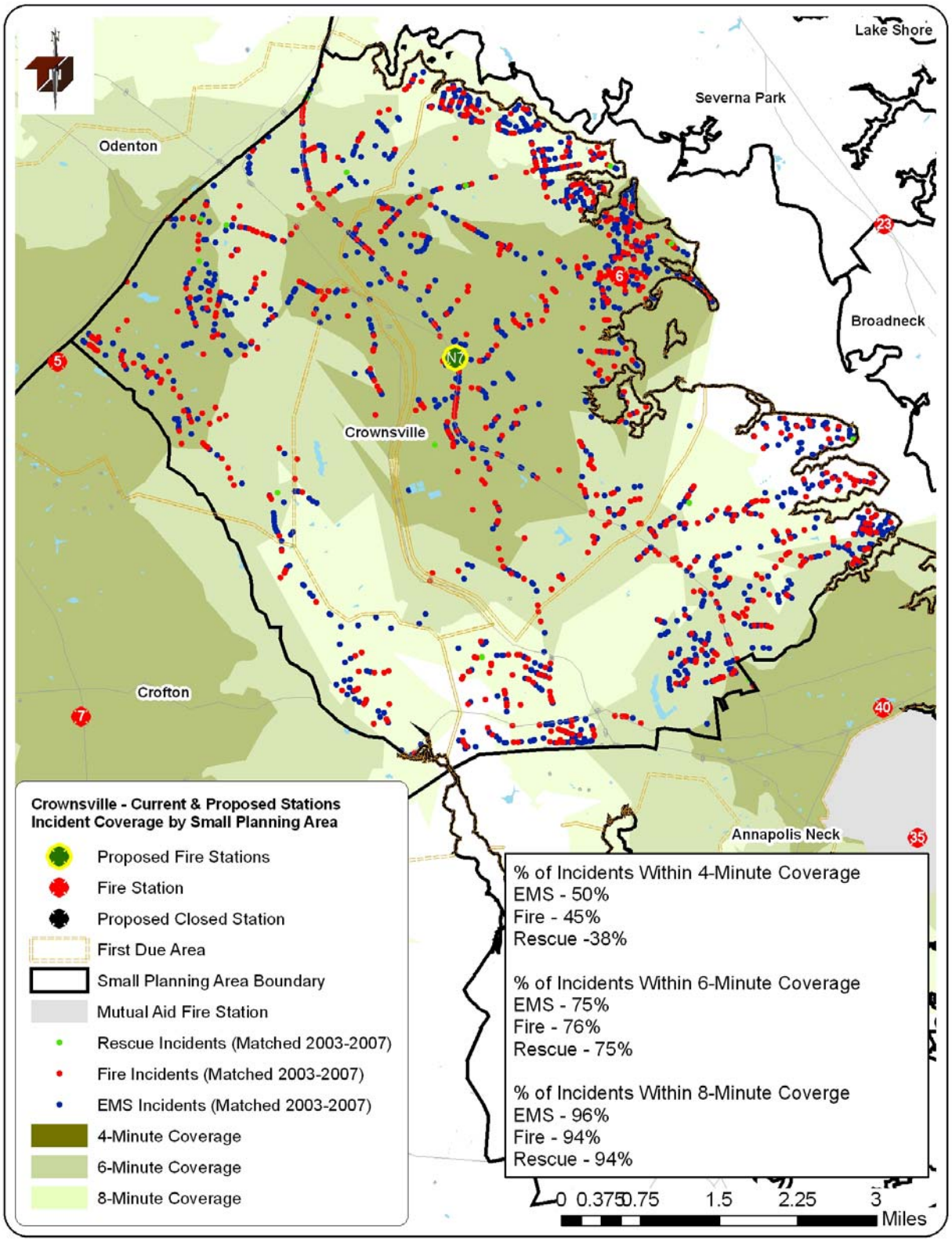
Station 6 is the only station in Crownsville and is in poor condition. The station is also located on the eastern coast of the planning area leaving much of the area to be covered by neighboring stations. Station 5 (Crofton) has some reach into Crownsville; however, this station is quite busy as shown previously in Map 19. A new station in the vicinity of Generals Highway and Herald Harbor Road will increase coverage in Crownsville. The existing station 6 may remain at its current location, staffed by volunteers, to provide supplemental coverage in the area. Map 22 shows the proposed coverage for the area. Map 23 is the proposed incident coverage for Crownsville with the new station and shows a marked increase in incident coverage. EMS incidents increase from 25 percent to 50 percent coverage at four minutes; fire incidents increase from 23 percent to 45 percent coverage at four minutes; and rescue incidents increase from 31 percent to 38 percent coverage at four minutes. Eight minute incident coverage is just short of 100 percent for all incidents for the proposed layout.

Recommendation 3 (High Priority): Build a new station (N7) in the vicinity of Generals Highway and Herald Harbor Road. Move the career personnel from station 6 to the new station for staffing. Volunteers may remain at the current station 6.

Map 22: Proposed Crownsville Coverage



Map 23: Proposed Crownsville Incident Coverage



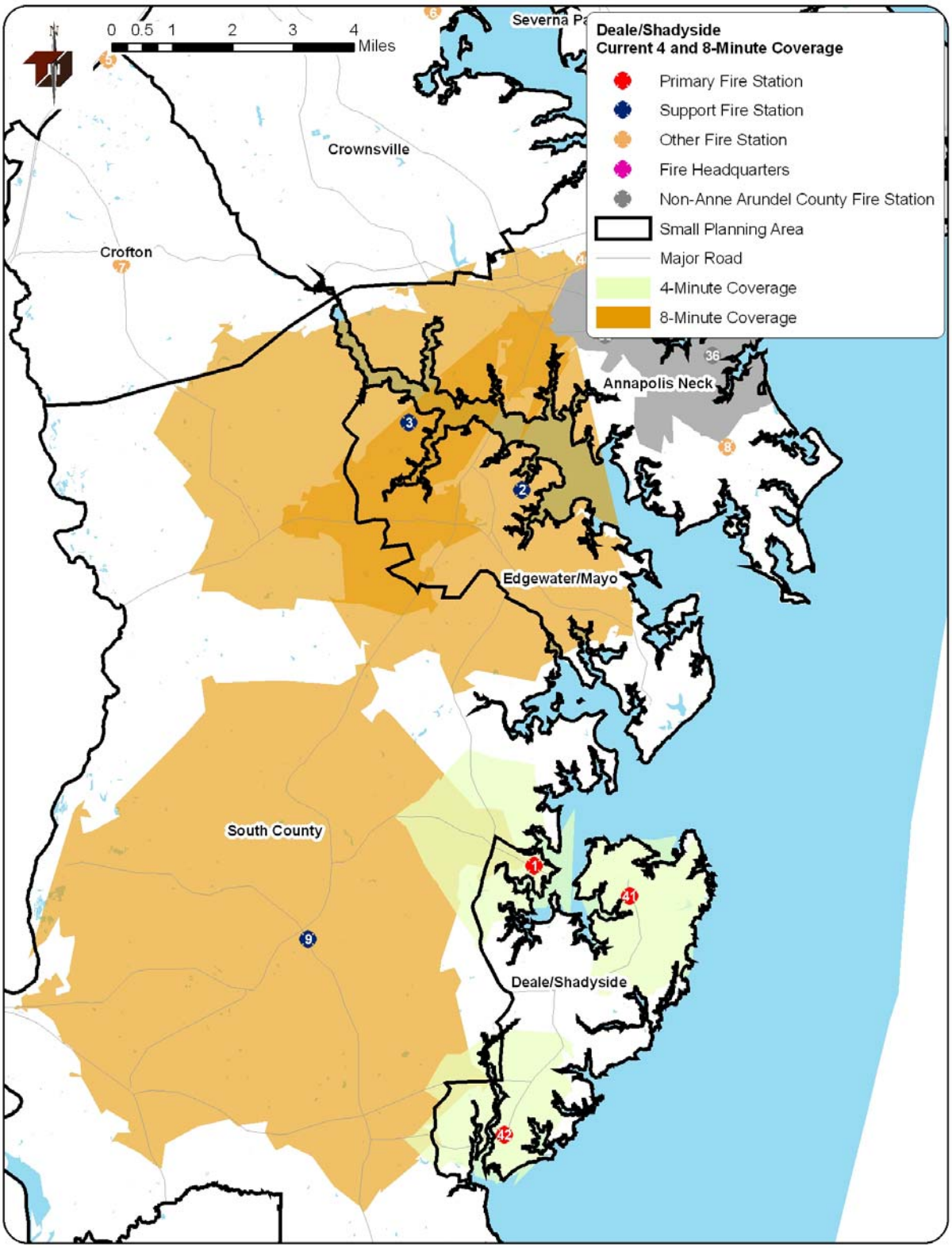
Deale/Shadyside – Deale/Shadyside has three primary fire stations located within its limits—stations 1, 41, and 42. Stations 2, 3, and 9 provide service to this area and are considered support stations. Mutual aid is provided by Calvert County station 1. Table 23 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 24 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 23: Deale/Shadyside Fire Stations

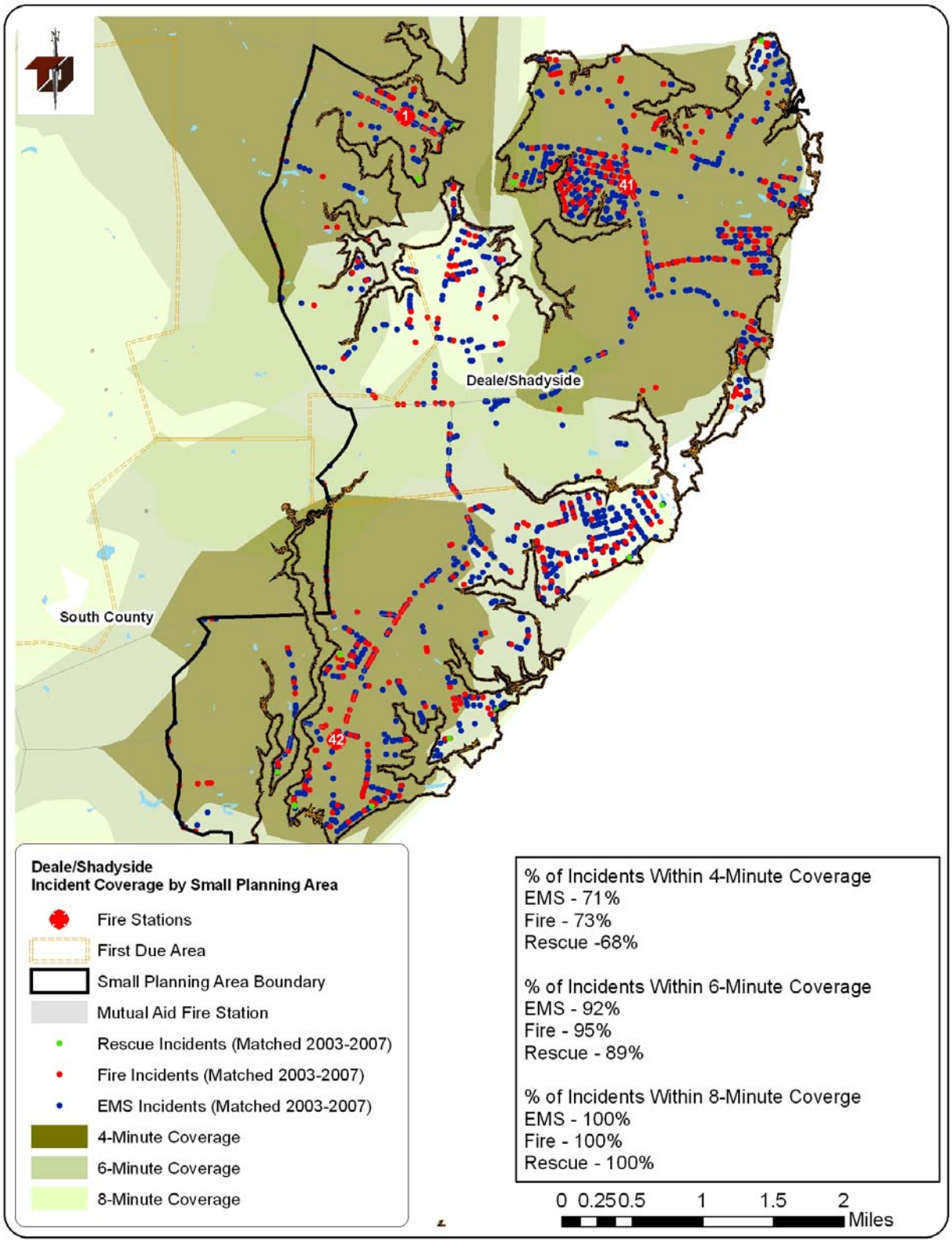
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
1	12 career, 0 volunteer	Engine (Co) Squad (Vo) Tanker (Co) Paramedic (Co)	8,365
41	20 career, 0 volunteer	Engine (Co) Ambulance (Co)	6,098
42	20 career, 22 volunteer	Medic (Co) Engine (Vo) Pumper/Tanker (Vo) Truck/Tower (Vo) 2 Fireboats (Vo)	10,242

The 2003–2007 emergency response count for the three fire stations (1, 41, and 42) was 24,705. Of those responses, 79.9 percent were EMS incidents, 18.7 percent were fire incidents, and 1.4 percent rescue incidents. When examining travel time reach in the Deale/Shadyside area regardless of responding station, 71 percent of EMS incidents, 73 percent of fire incidents, and 68 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 25 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Deale/Shadyside small planning area averaged 4 minutes 34 seconds with a 90th percentile measure of 8 minutes 32 seconds.

Map 24: Current Deale/Shadyside Coverage



Map 25: Current Deale/Shadyside Incident Coverage

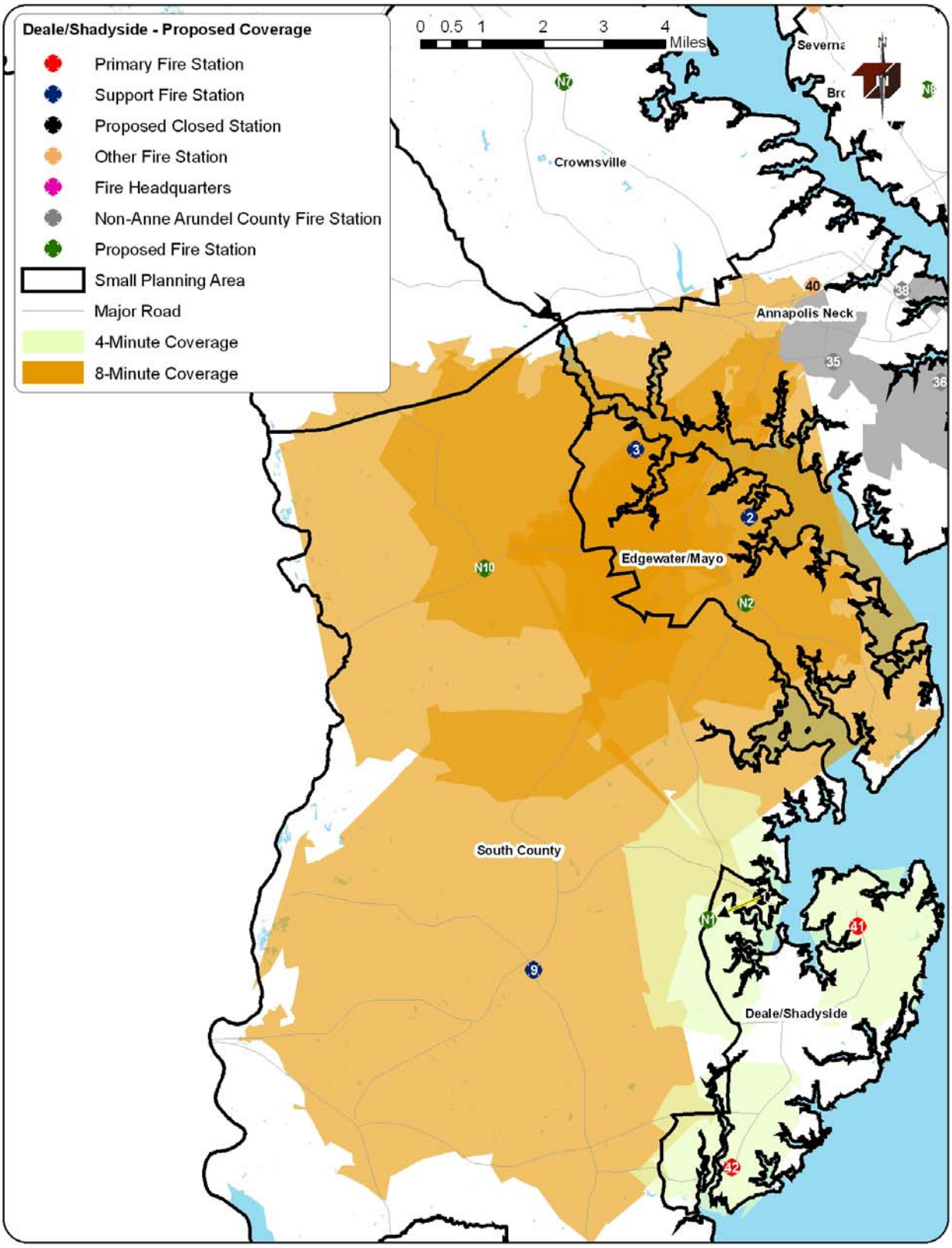


The majority of Deale/Shadyside is well covered with the existing three stations; however station 1 is outdated and located in an extreme corner of the planning area. Building a new station in the area just southwest of its current location may create more efficient coverage in Deale/Shadyside and provide greater support to the South County small planning area. The Deale/Shadyside incident coverage is essentially equal in both the current and proposed configurations; however, the new station location does contribute to an increase in incident coverage for South County.

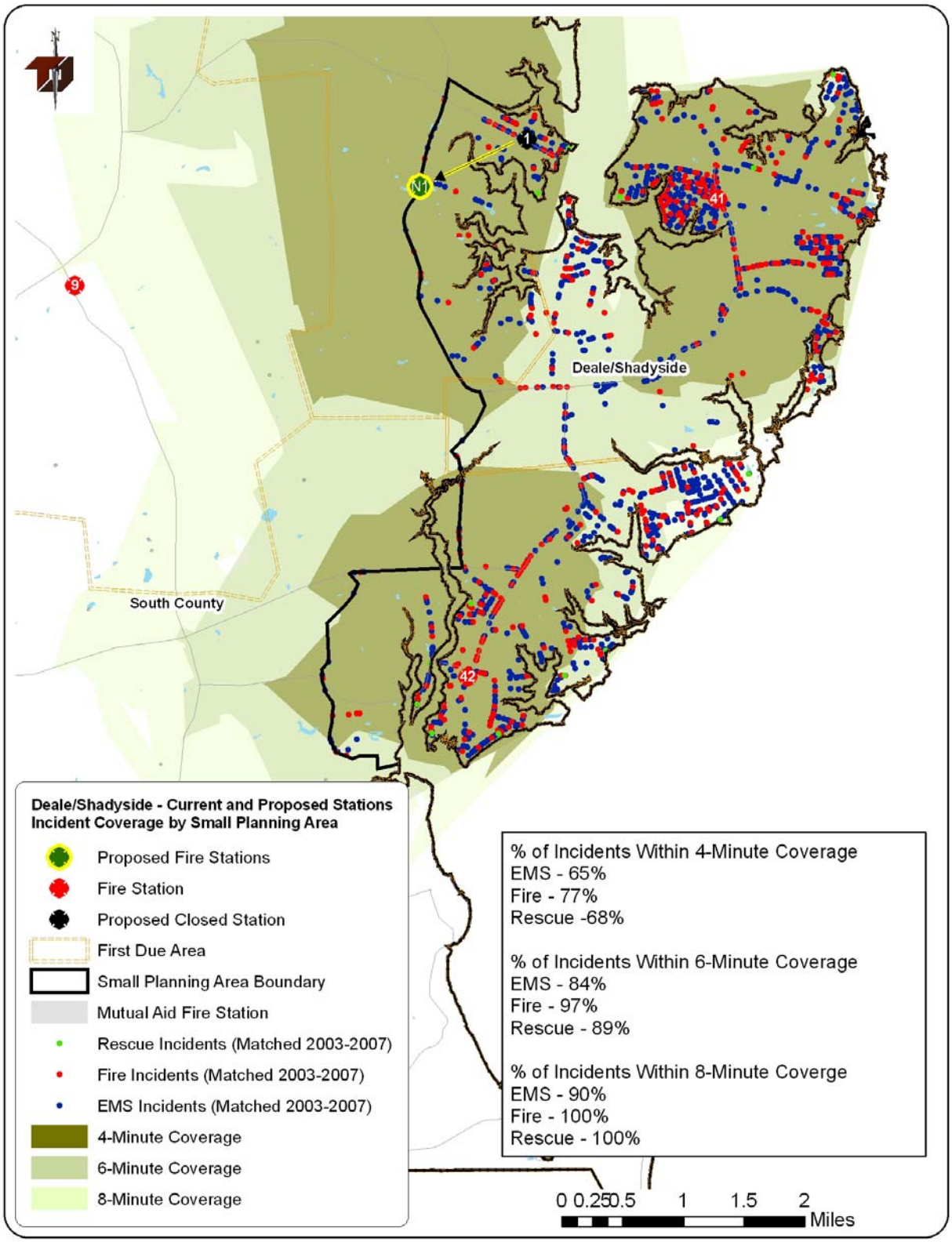
Map 26 and Map 27 show the proposed coverage and proposed incident coverage, respectively.

Recommendation 4 (Very High Priority): Build a new station 1 (N1) in the vicinity of Crandell Road and Muddy Creek Road.

Map 26: Proposed Deale/Shadyside Coverage

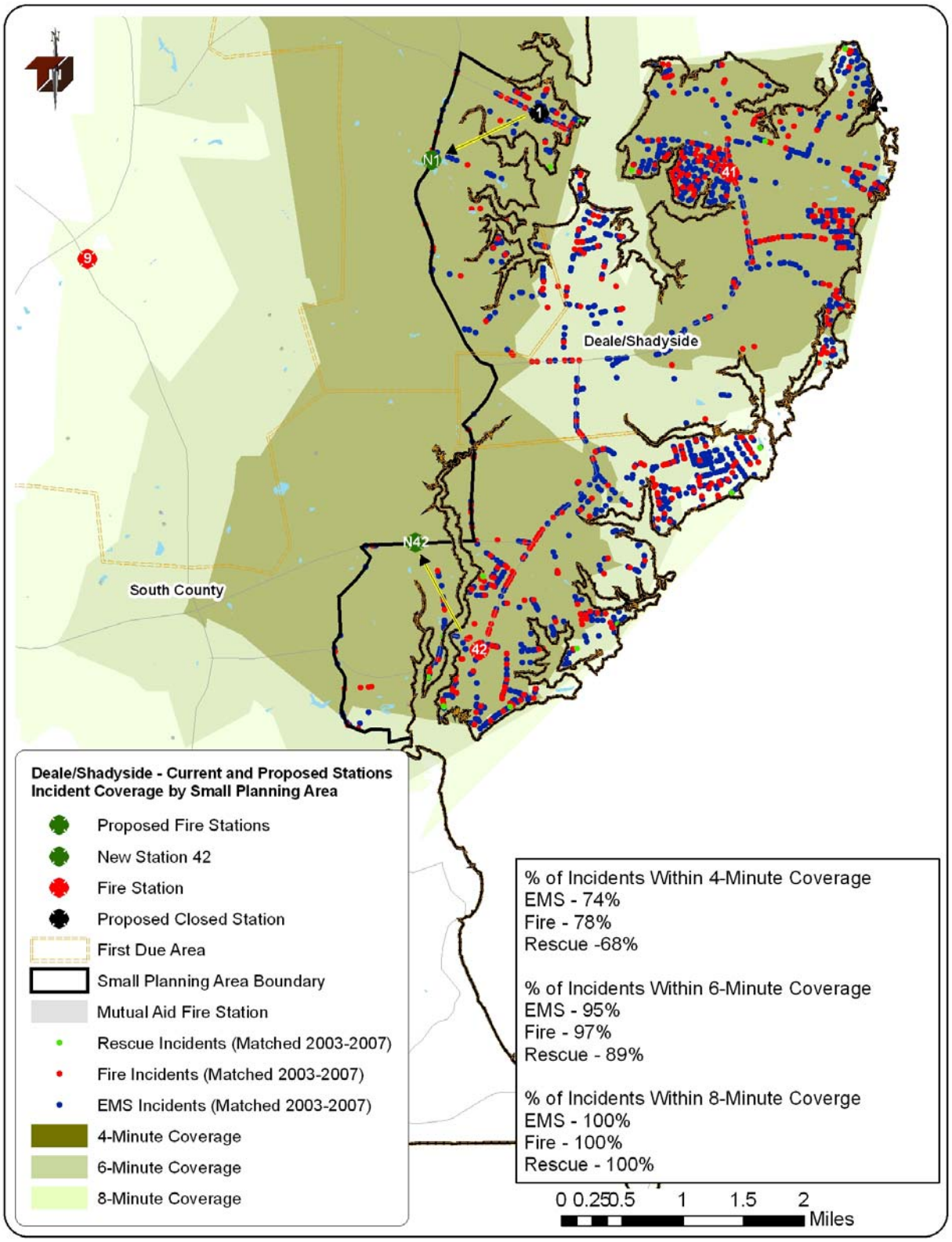


Map 27: Proposed Deale/Shadyside Incident Coverage



Update – The Deale volunteers from station 42 purchased land on the north side of Route 258 approximately one-eighth of a mile west of the intersection with Rockhold Creek Road. The volunteers from station 42 are proposing to build a new station at this location and close the existing station. An analysis was completed for the new station 42 using two scenarios—the current station deployment and the proposed station deployment. Overall, there were very slight variations for both scenarios. The most change was with the proposed deployment scenario. The new location of station 42, together with Recommendation 4, increases EMS coverage at four, six, and eight minutes. Incident coverage increased from 65 percent to 74 percent at four minutes, 84 percent to 95 percent at six minutes, and 90 percent to 100 percent at eight minutes. Map 28 shows the proposed coverage for Deale/Shadyside with the new station 42.

Map 28: Proposed Deale/Shadyside Incident Coverage with New Station 42



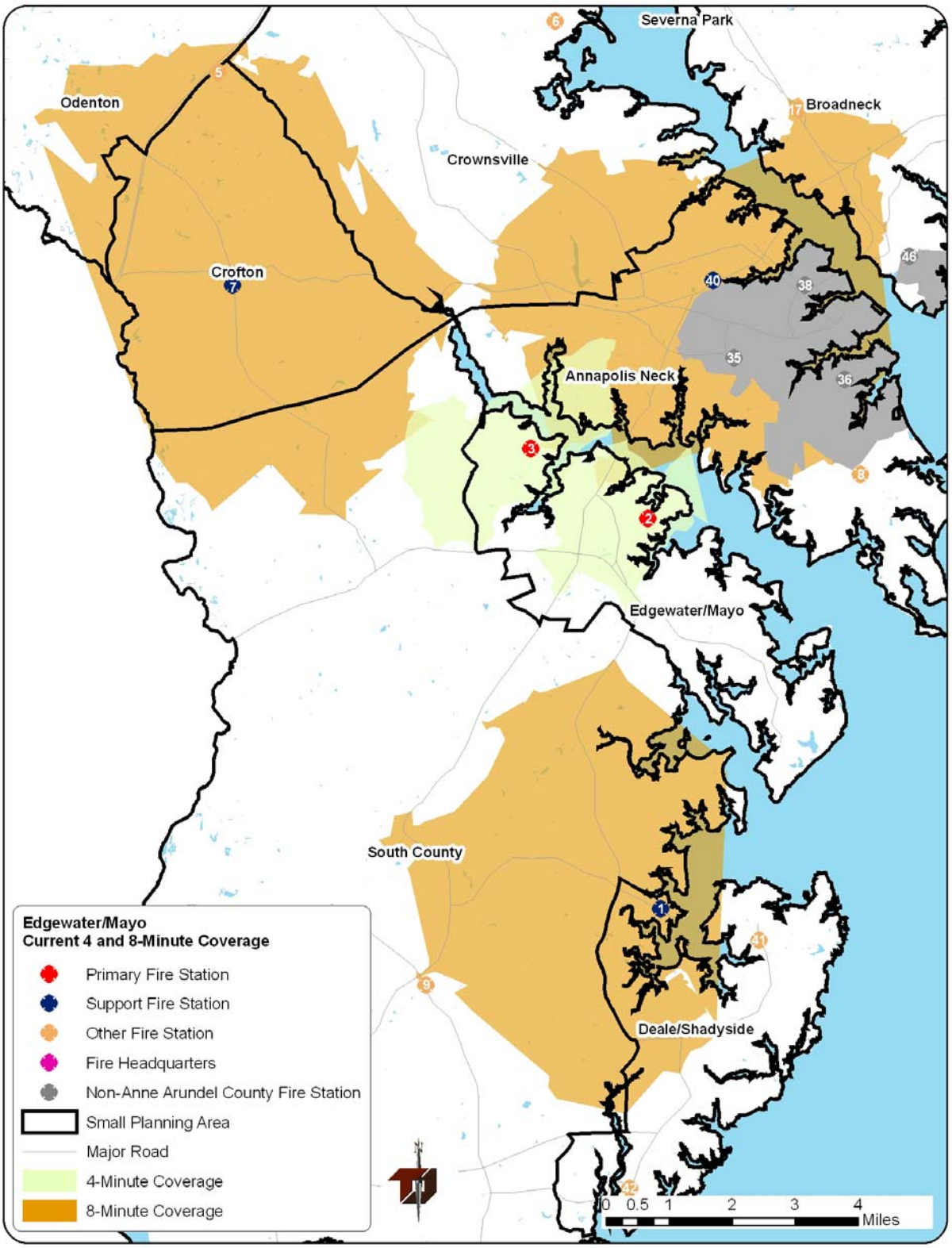
Edgewater/Mayo – Edgewater/Mayo has two primary fire stations located within its limits—Stations 2 and 3. Stations 1, 7, and 40 provide service to this area and are considered support stations. Table 24 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 29 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 24: Edgewater/Mayo Fire Stations

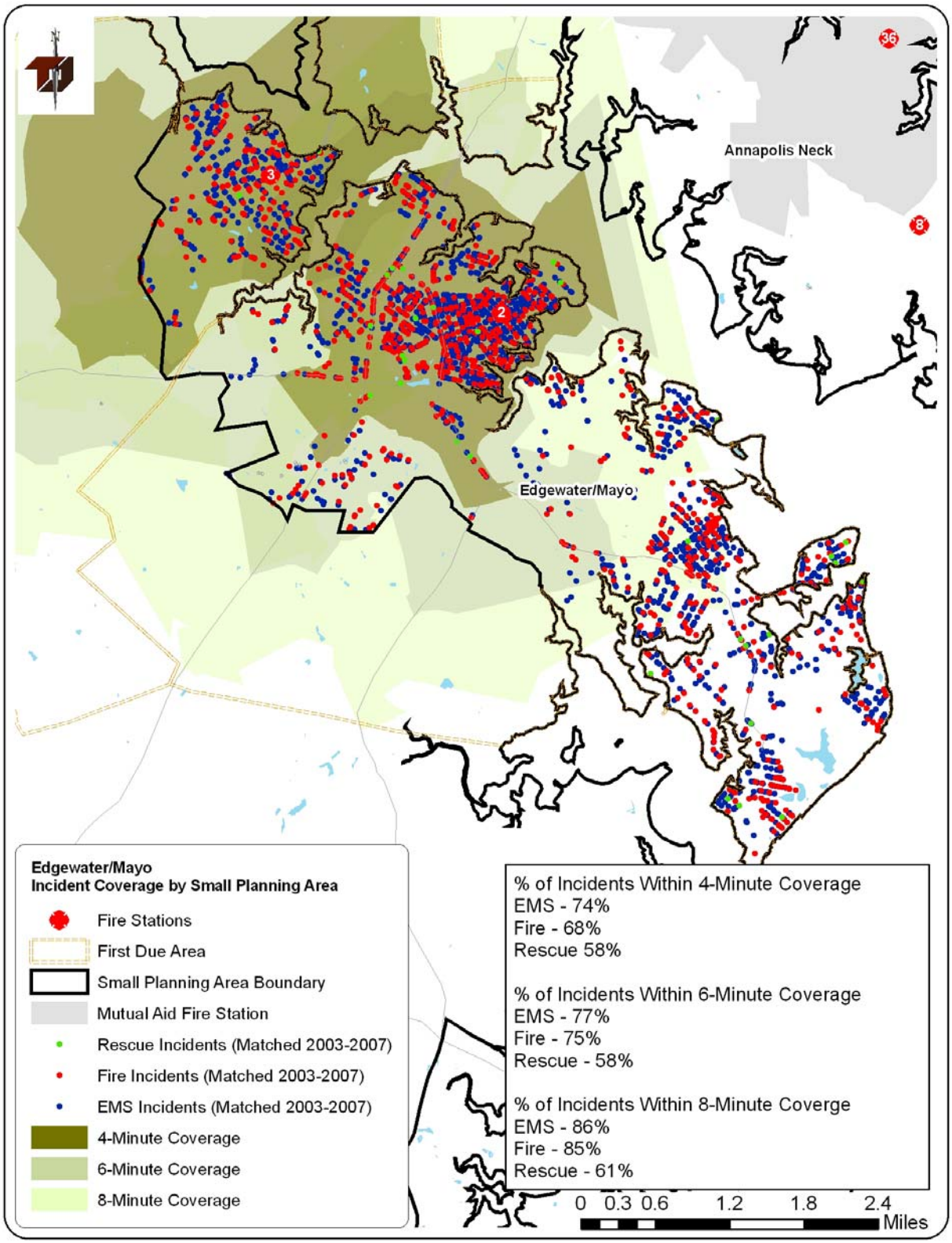
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
2	20 career, 38 volunteer	Paramedic Engine (Co) Engine (Vo) Medic (Co) Squad (Vo)	18,931
3	36 career, 0 volunteer	Paramedic (Co) Engine (Vo) Pumper/Tanker (Vo) 2 Tankers (Vo)	26,014

The 2003–2007 emergency response count for the two fire stations (2 and 3) was 44,945. Of those responses, 77.8 percent were EMS incidents, 21.4 percent were fire incidents, and 0.8 percent rescue incidents. When examining travel time reach in the Edgewater/Mayo area regardless of responding station, 74 percent of EMS incidents, 68 percent of fire incidents, and 58 percent of rescue incidents were located within a four minute travel time of existing stations; 86 percent of EMS incidents, 85 percent of fire incidents, and 61 percent of rescue incidents were located within an eight minute travel time of existing stations. Map 30 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Edgewater/Mayo small planning area averaged 4 minutes 20 seconds with a 90th percentile measure of 8 minutes 14 seconds.

Map 29: Edgewater/Mayo Current Coverage



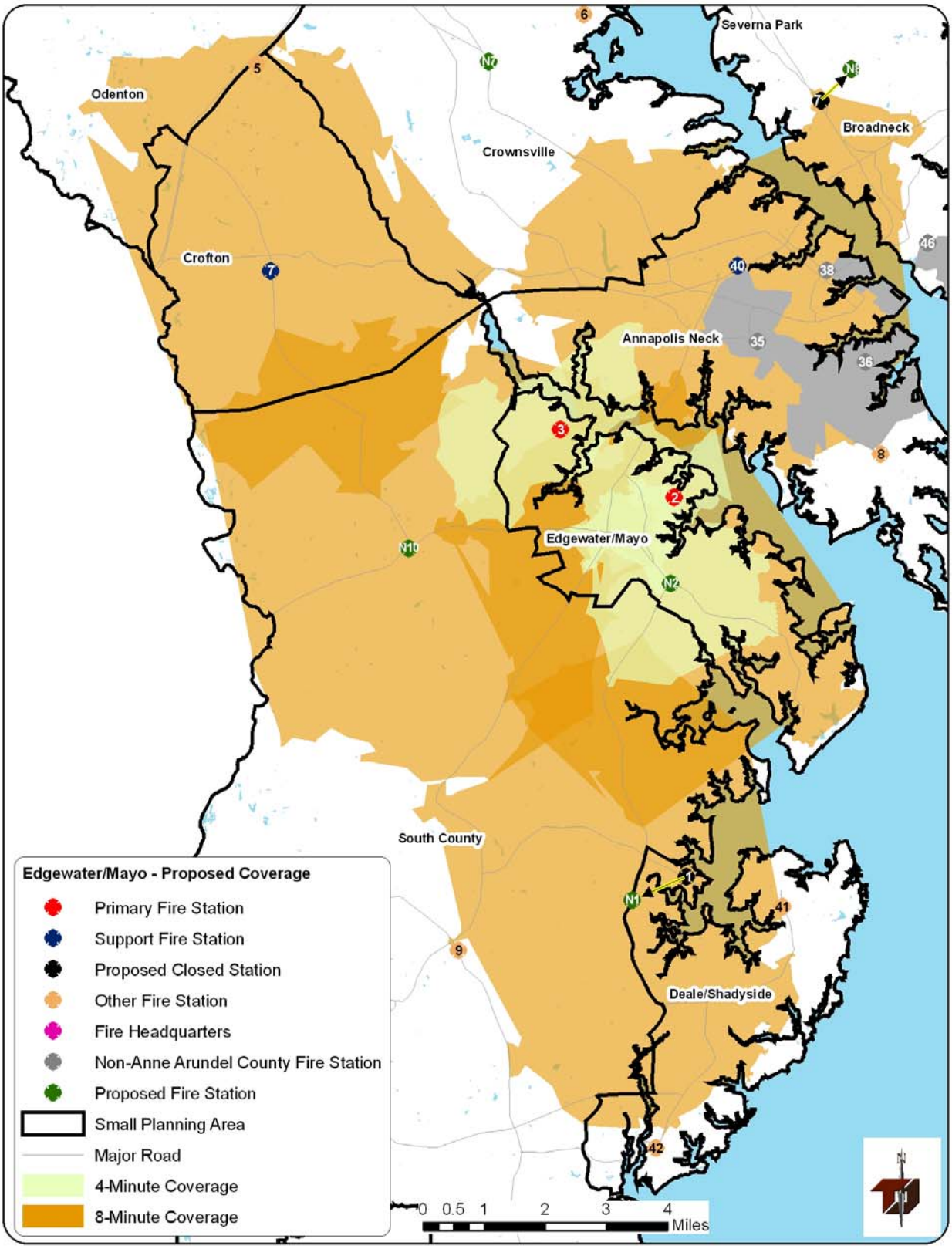
Map 30: Edgewater/Mayo Current Incident Coverage



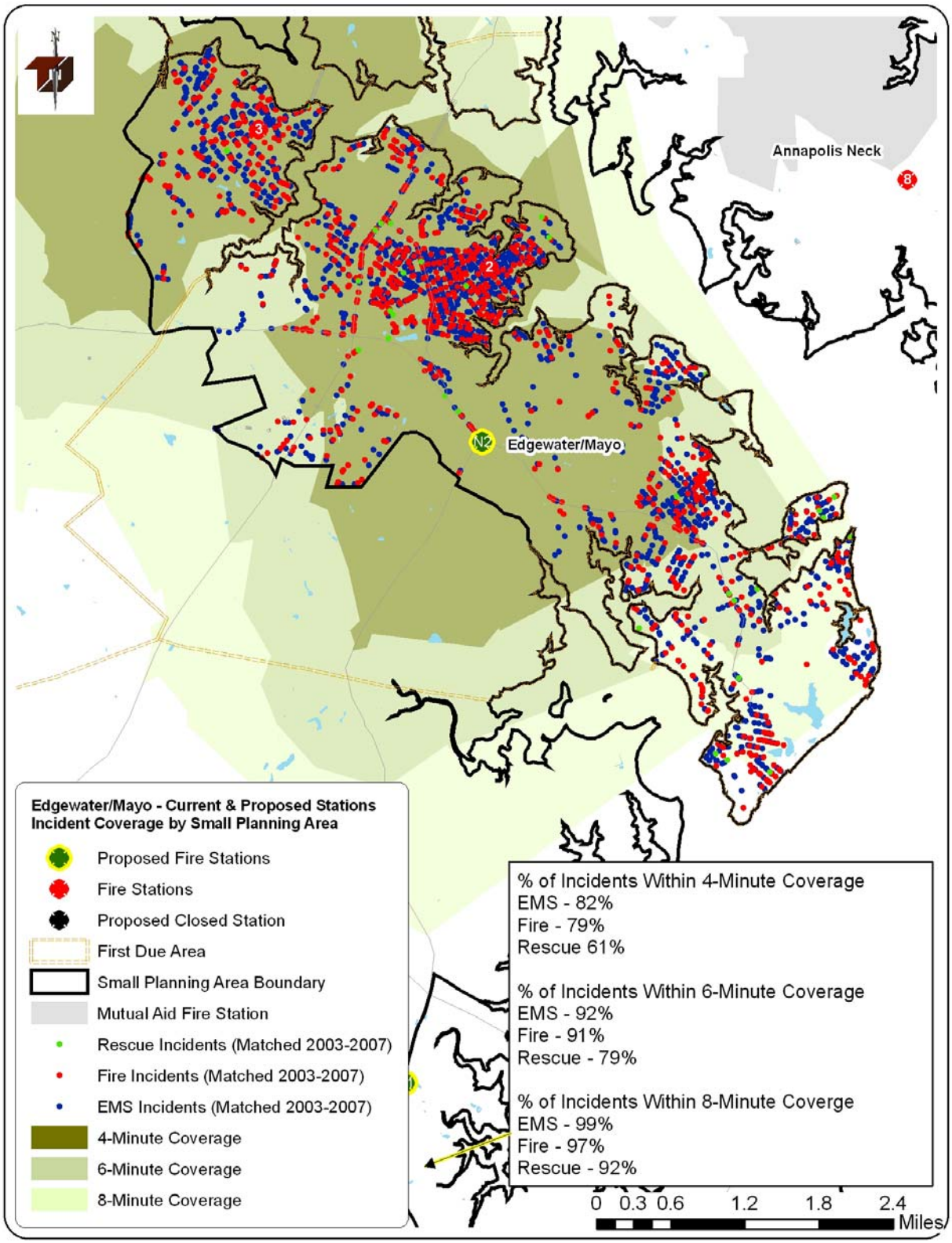
Station 2 is a marginal facility located in the north half of Edgewater/Mayo. The only other station in this planning area is station 3, located on the northern edge of this small planning area. This configuration creates a large gap in coverage on the southern peninsula of Edgewater/Mayo. While much of the incident volume is in the northern half of Edgewater/Mayo, there is still moderate activity (approximately 15 percent of fire and EMS incidents from 2003 through 2007) in the southern portion outside of eight minute coverage. Building a new station to the south of station 2 will provide better coverage for the area. The new station is recommended to be built near the intersection of Muddy Creek Road and Central Avenue (Route 214) and staffed with career personnel from station 2. Volunteers may remain at the current station 2 to provide supplemental coverage. Map 31 shows the proposed coverage and Map 32 shows the proposed incident coverage for Deale/Shadyside. The new station configuration in this area would have covered just under 100 percent of 2003 through 2007 incidents in the area.

Recommendation 5 (High Priority): Build a new station in the vicinity of Muddy Creek Road and Central Avenue/Route 214 (N2). Move the career personnel from station 2 to the new station. Volunteers may remain at the current station 2.

Map 31: Proposed Edgewater/Mayo Coverage



Map 32: Proposed Edgewater/Mayo Incident Coverage



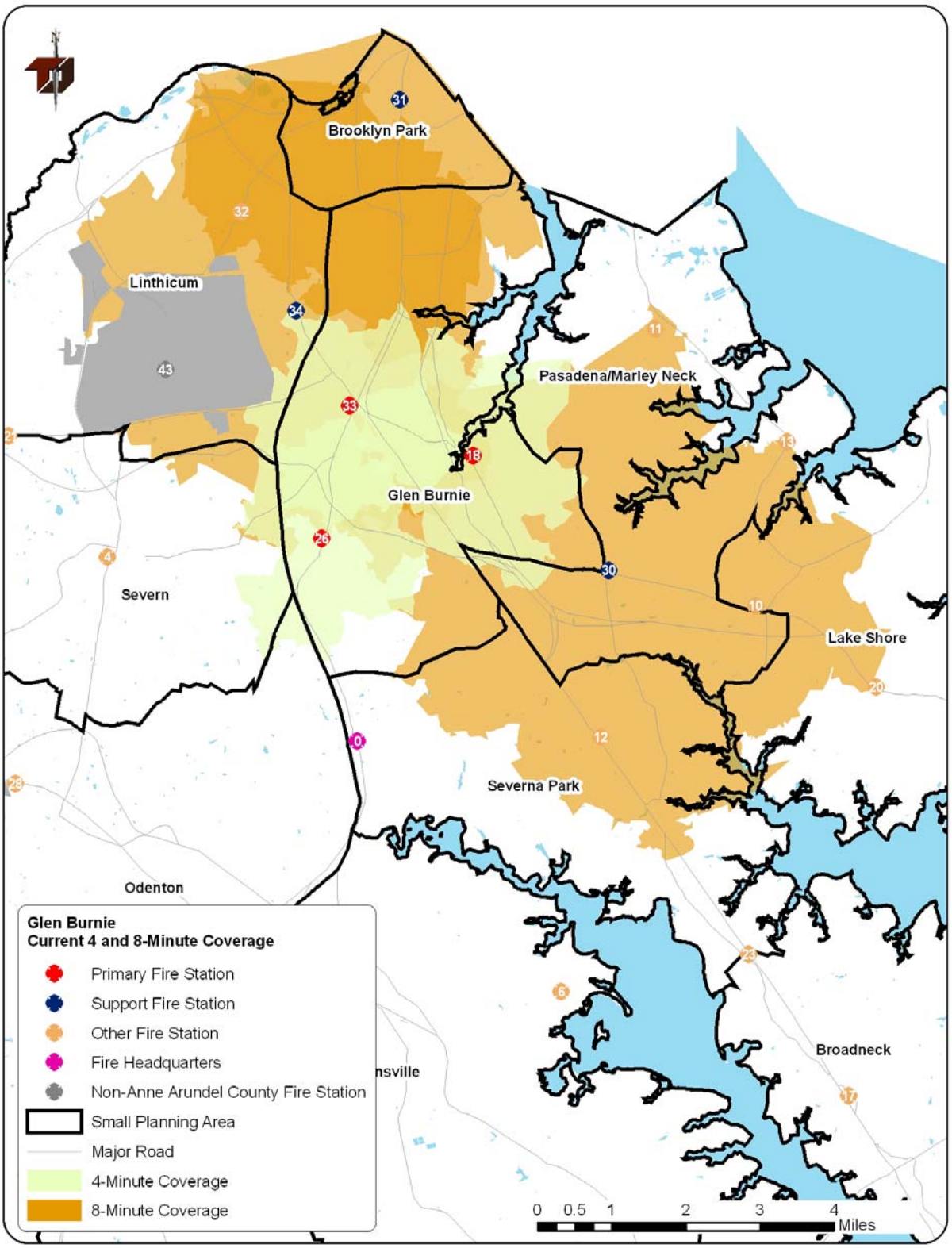
Glen Burnie – Glen Burnie has three primary fire stations located within its limits—Stations 18, 26, and 33. Stations 30, 31, and 34 provide service to this area and are considered support stations. Table 25 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 33 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 25: Glen Burnie Fire Stations

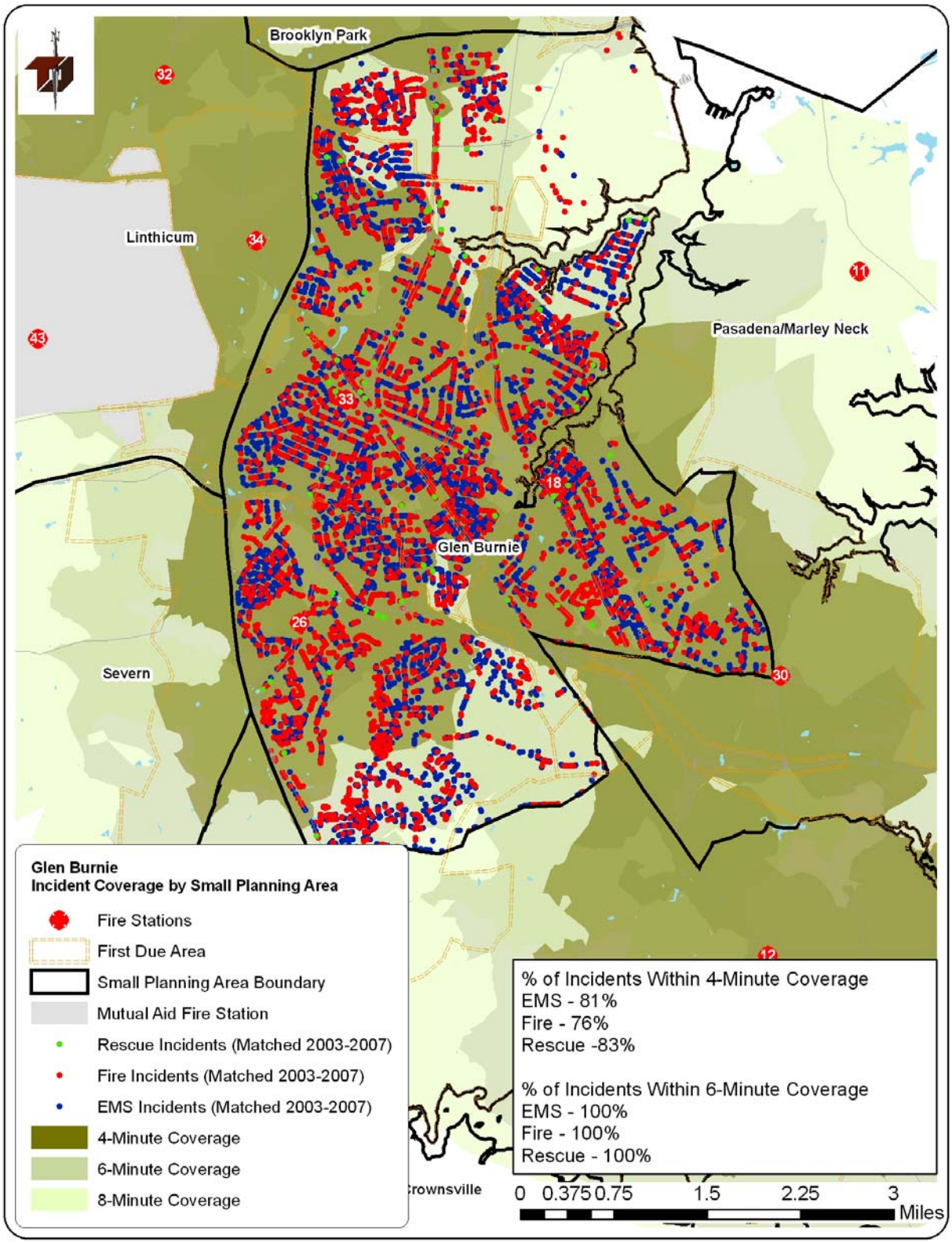
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
18	24 career, 0 volunteer	Engine (Co) Paramedic (Co)	33,503
26	40 career, 0 volunteer	Engine (Co) Truck/Tower (Co) Paramedic (Co)	47,601
33	44 career, 33 volunteer	Engine (Co) Engine (Vo) Truck/Tower (Co) Ambulance (Vo) Paramedic (Co) Squad (Vo)	46,616

The 2003–2007 emergency response count for the three fire stations 18, 26, and 33) was 127,720. Of those responses, 80.5 percent were EMS incidents, 18.9 percent were fire incidents, and 0.6 percent rescue incidents. When examining travel time reach in the Glen Burnie area regardless of responding station, 81 percent of EMS incidents, 76 percent of fire incidents, and 83 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 34 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Glen Burnie small planning area averaged 3 minutes with a 90th percentile measure of 4 minutes 54 seconds.

Map 33: Glen Burnie Current Coverage



Map 34: Glen Burnie Current Incident Coverage



As shown in Map 34, the Glen Burnie small planning area has been the busiest area for all incidents between the years of 2003 and 2007. In general, the coverage is good with adequate support from surrounding stations. However, as this is a highly dense area, a modification in the location station 26 may provide a more optimal coverage pattern. Moving existing station 26 to the south towards Millersville could achieve more effective coverage for the area. In addition, moving a truck/tower from station 33 or station 26 to station 21 can reduce redundancy and provide more efficient coverage to the area.

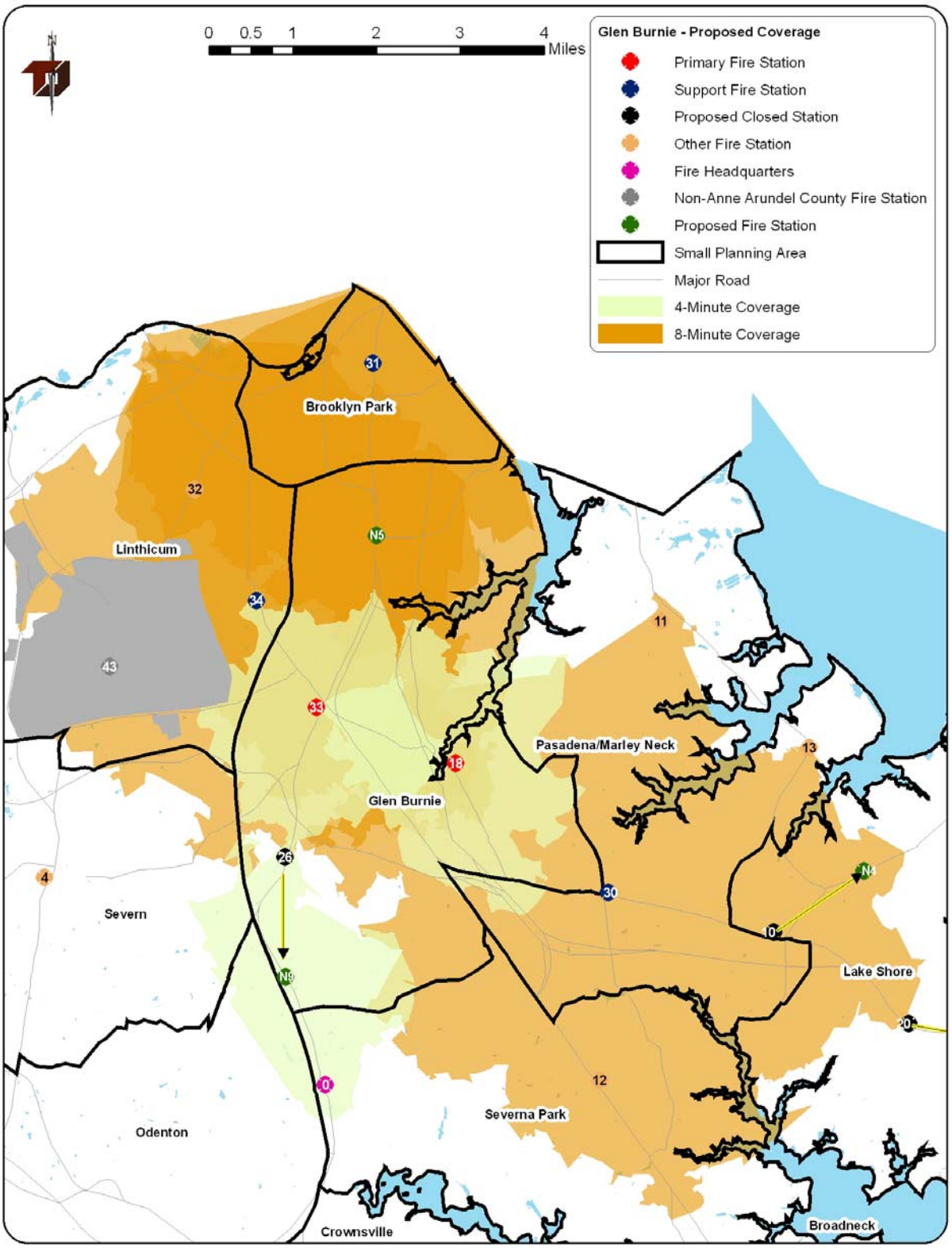
Recommendation 6 (Low Priority): Close station 26 and build a new station in the vicinity of Veteran's Highway and Old Mill Road (N9).

Recommendation 7 (Low Priority): Move the truck/tower from station 33 or 26 to station 21.

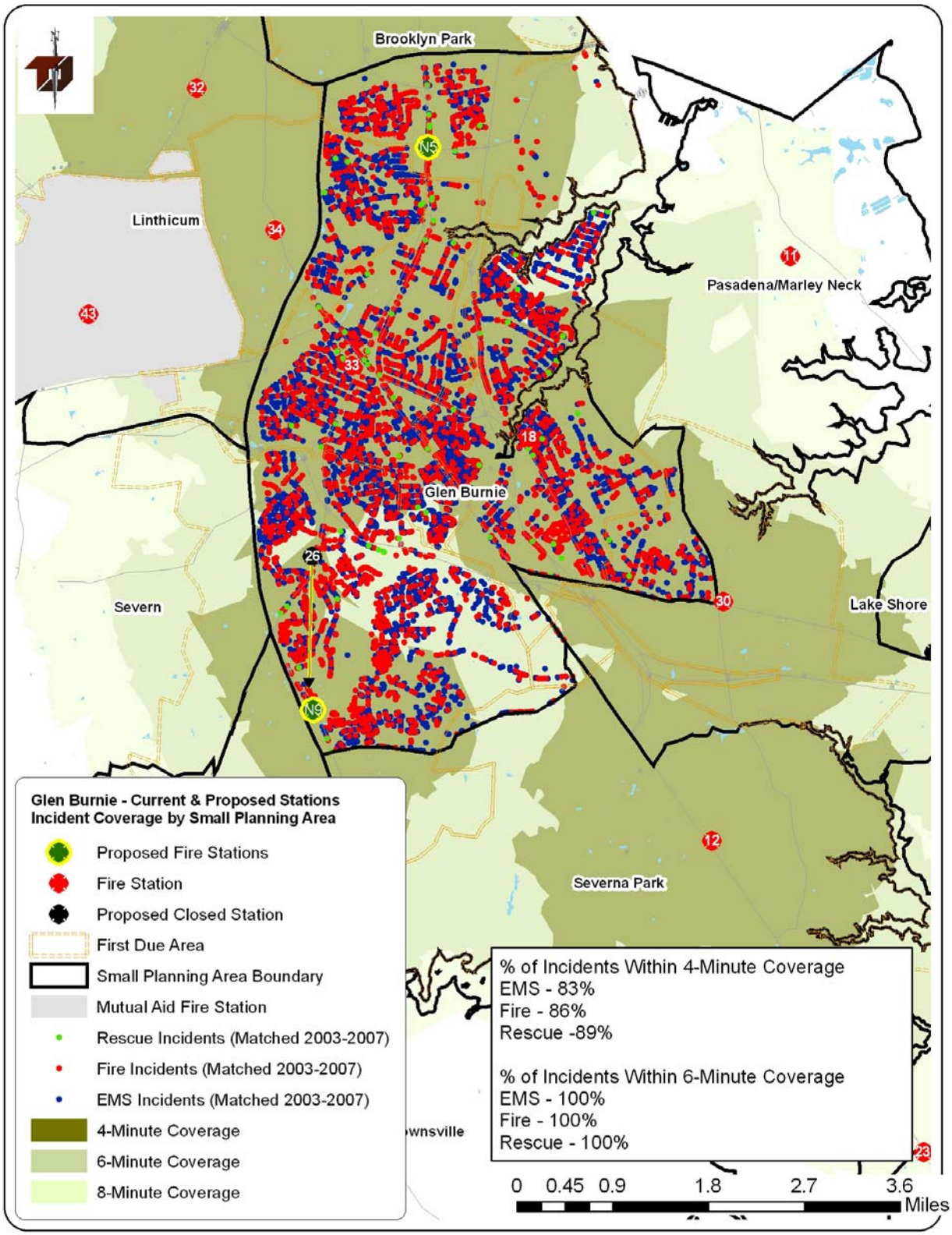
Due to the high incident volume in Glen Burnie and surrounding planning areas (as shown in Map 3 through Map 6), moving a station into Glen Burnie may create a more efficient coverage pattern while maintaining and/or improving on existing coverage. Building a new station 34, currently located in the BWI/Linthicum small planning area, in the vicinity of Ritchie Highway and East Ordnance Road will help to create more efficient overlap. The current station 34 could remain in its current location and be staffed by the volunteers presently at this location. Map 35 and Map 36 show the proposed coverage and proposed incident coverage, respectively.

Recommendation 8 (Low Priority): Build a new station in the vicinity of Ritchie Highway and East Ordnance Road in Brooklyn Park. Move the career personnel from the existing station 34 to the new station. Volunteers may remain at the current station 34 in BWI/Linthicum.

Map 35: Proposed Glen Burnie Coverage



Map 36: Proposed Glen Burnie Incident Coverage



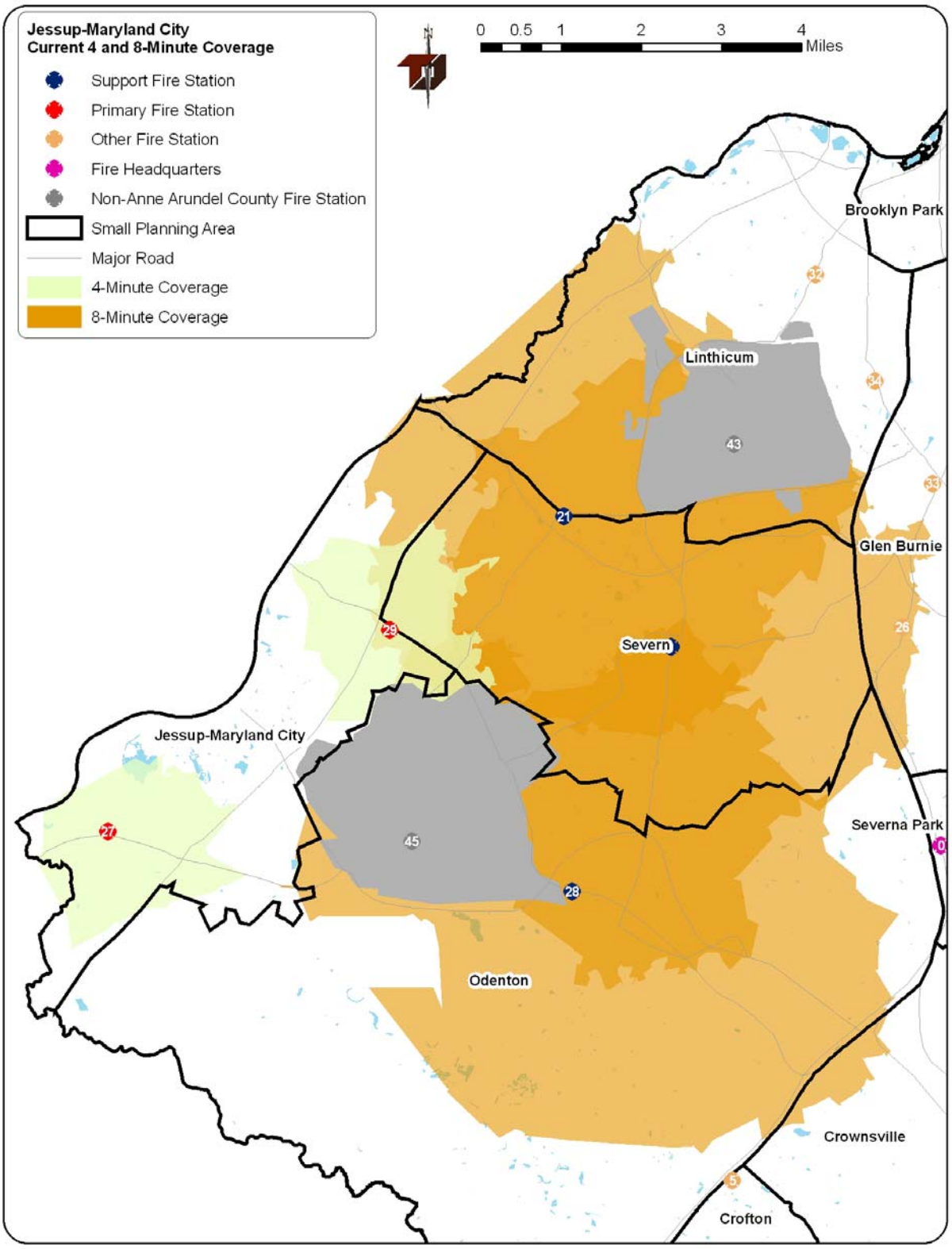
Jessup-Maryland City – Jessup-Maryland City has two primary fire stations located within its limits—Stations 27 and 29. Stations 4, 21, and 28 provide service to this area and are considered support stations. Mutual aid is provided by Prince George's County station 49 (Laurel) and Ft. Meade (station 45). Table 26 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 37 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 26: Jessup-Maryland City Fire Stations

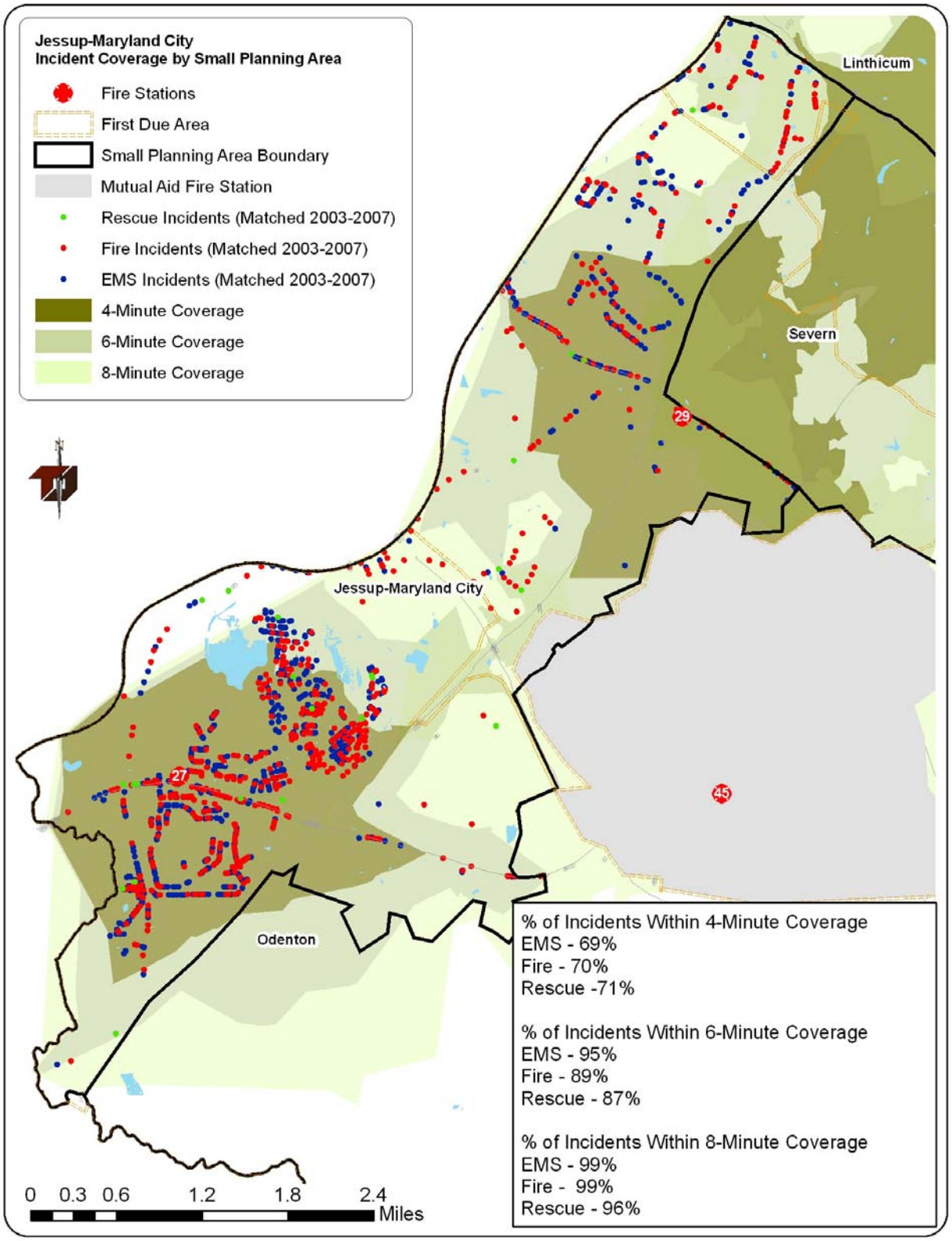
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
27	12 career, 29 volunteer	Engine (Co) Engine (Vo) Paramedic (Co) Ambulance (Co)	15,047
29	24 career, 3 volunteer	Pumper/Tanker (Co) Paramedic (Co)	21,999

The 2003–2007 emergency response count for the two fire stations (27 and 29) was 37,046. Of those responses, 79.6 percent were EMS incidents, 19.7 percent were fire incidents, and 0.8 percent rescue incidents. When examining travel time reach in the Jessup-Maryland City area regardless of responding station, 69 percent of EMS incidents, 70 percent of fire incidents, and 71 percent of rescue incidents were located within a four minute travel time of existing stations; 99 percent of EMS and fire incidents and 96 percent of rescue incidents were located within an eight minute travel time of existing stations. Map 38 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Jessup-Maryland City small planning area averaged 3 minutes 30 seconds with a 90th percentile measure of 5 minutes 48 seconds.

Map 37: Jessup-Maryland City Current Coverage



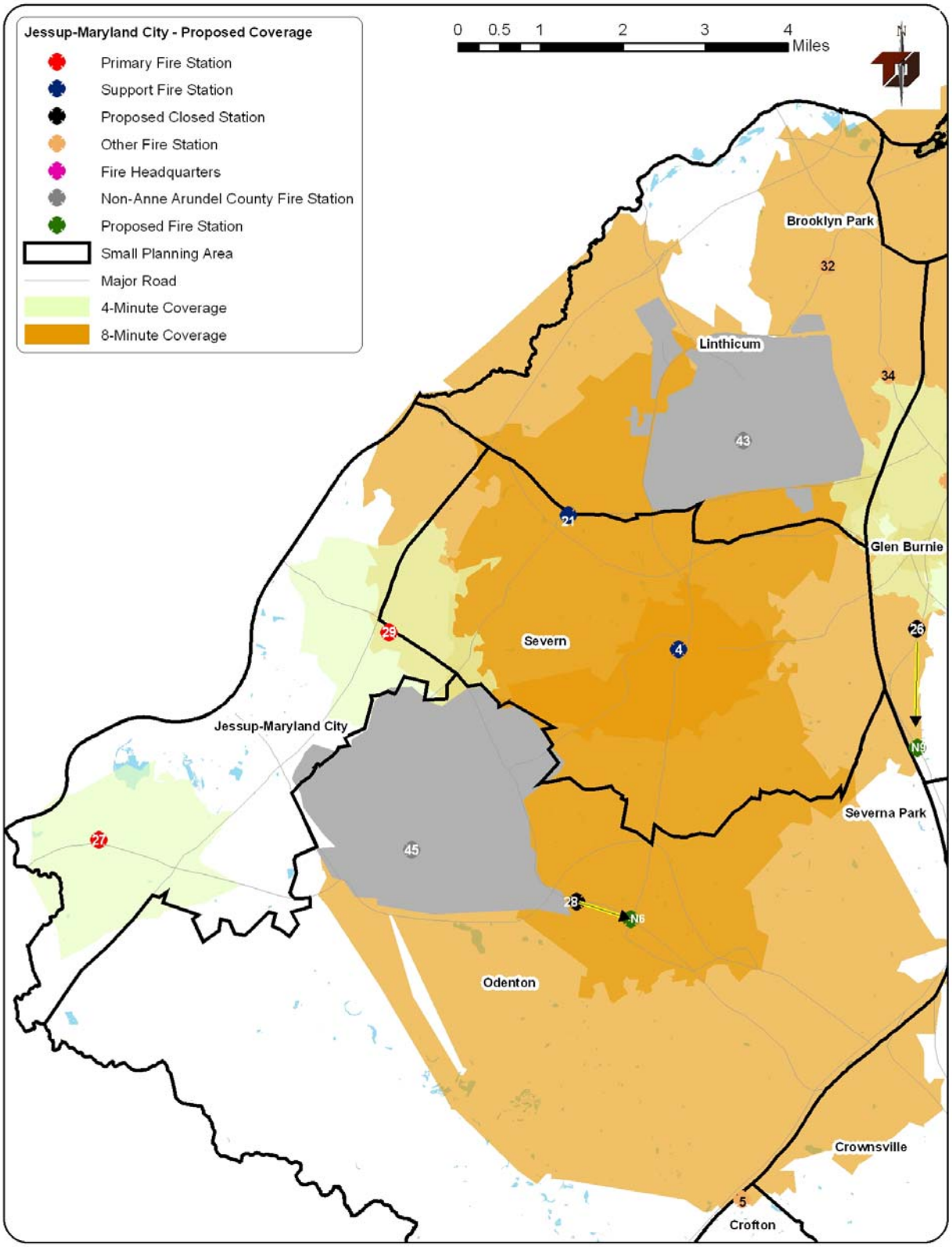
Map 38: Jessup-Maryland City Current Incident Coverage



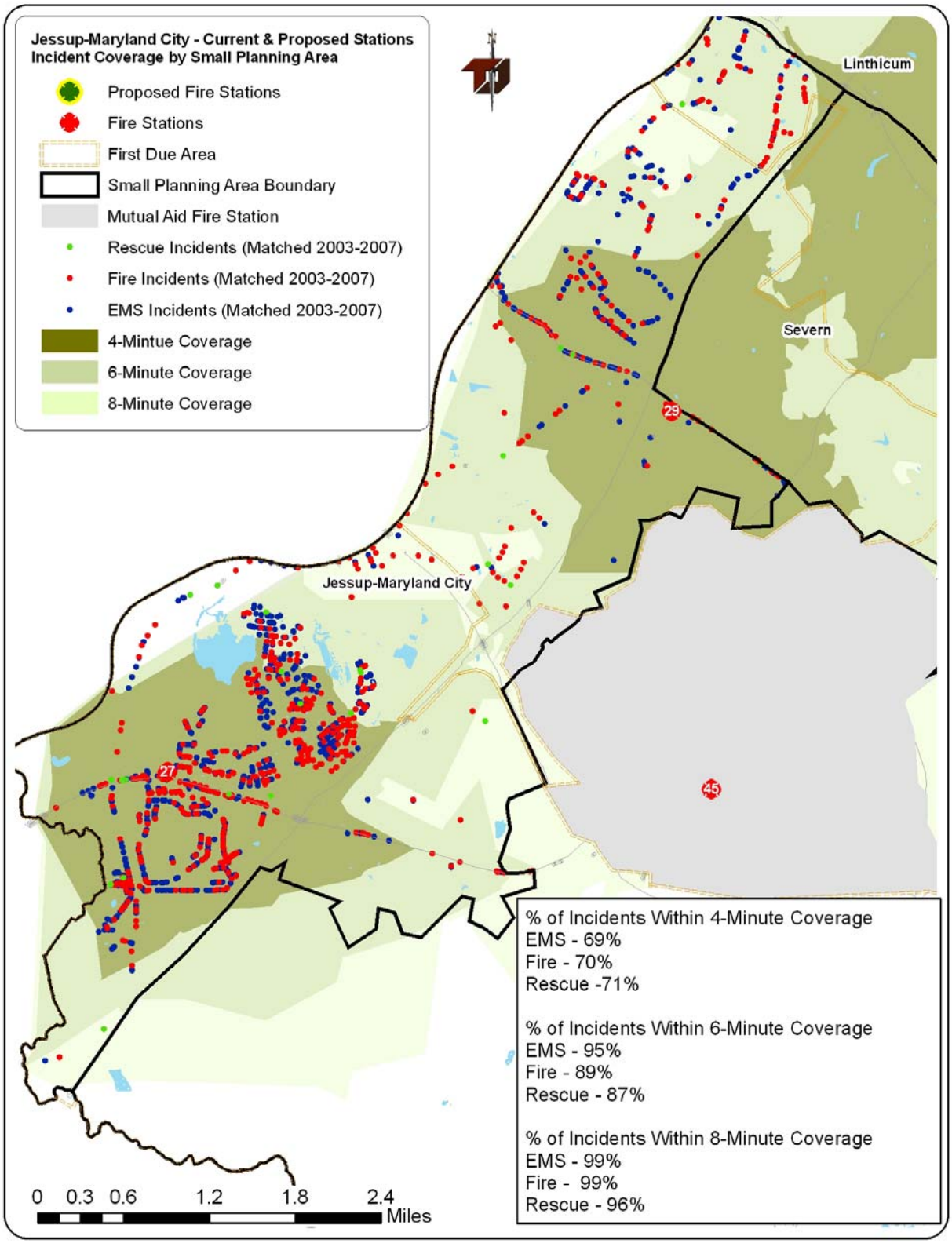
The stations in the Jessup-Maryland City small planning area are well-located and are providing good coverage to the area. Station 29 is an inadequate facility with water/sewer issues, but the facility location is good. This facility should be considered for updating in conjunction with the proposed changes to nearby Route 175. The proposed coverage maps are shown in Map 39 and Map 40, with only a slight modification in coverage due to the relocation of station 28 (discussed in the Odenton section).

Recommendation 9 (Low Priority): Update station 29 to address building condition and water/sewer issues taking into account the timing of proposed changes to Route 175.

Map 39: Proposed Jessup-Maryland City Coverage



Map 40: Proposed Jessup-Maryland City Incident Coverage



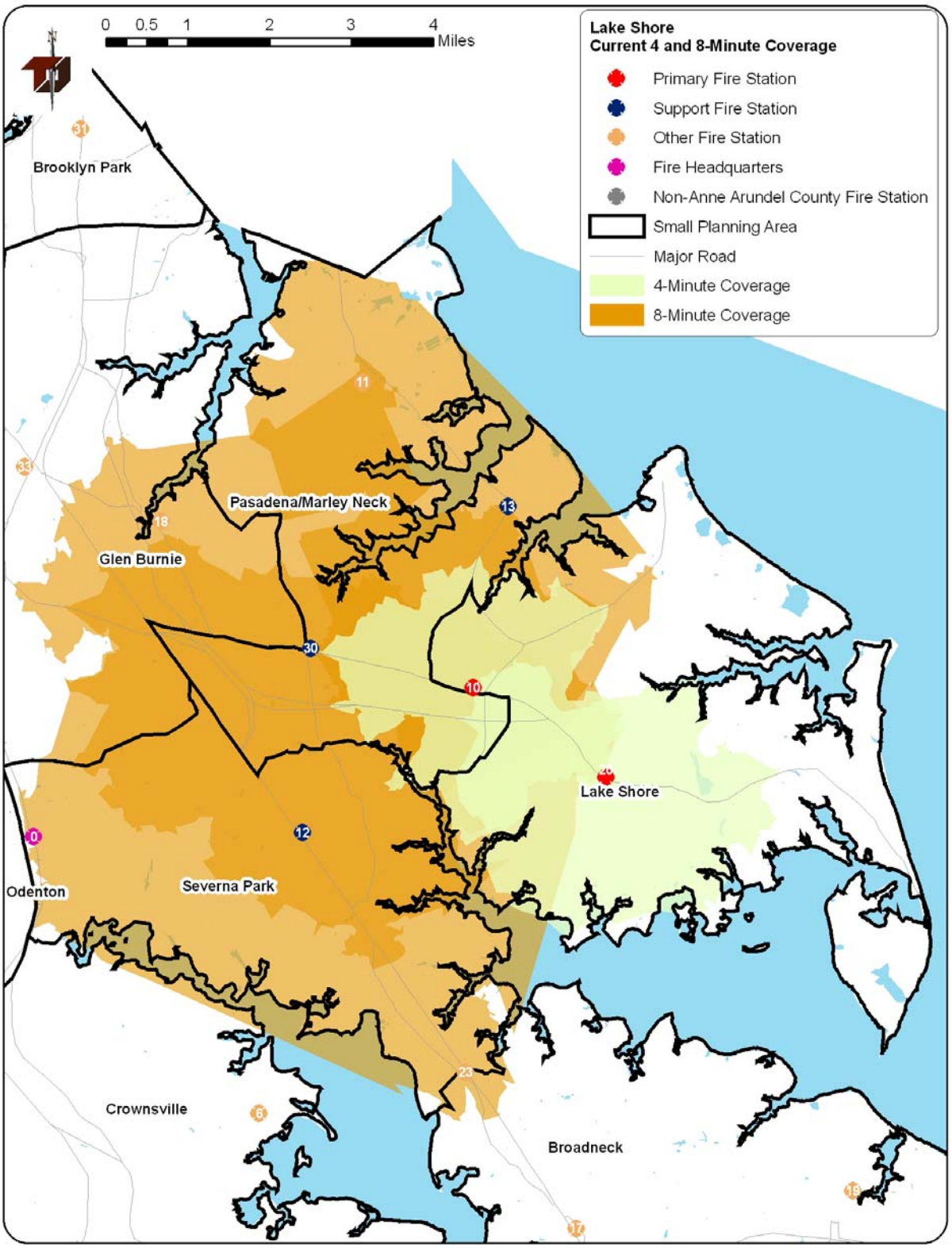
Lake Shore – Lake Shore has two primary fire stations located within its limits—Stations 10 and 20. Stations 12, 13, and 30 provide service to this area and are considered support stations. Table 27 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 41 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 27: Lake Shore Fire Stations

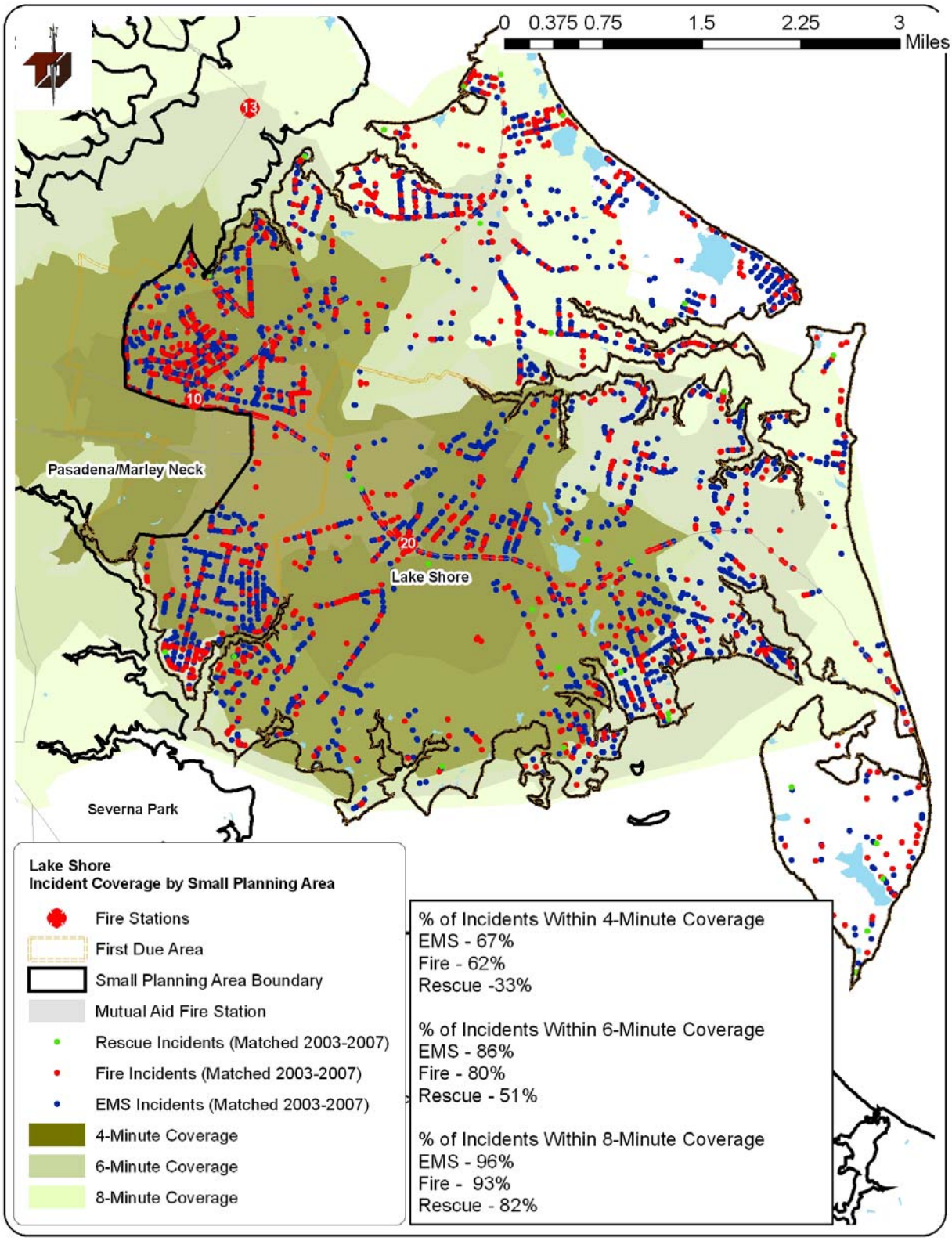
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
10	28 career, 0 volunteer	Pumper/Tanker (Co) Paramedic (Co)	24,015
20	16 career, 23 volunteer	Engine (Vo) Pumper/Tanker (Vo) Ambulance (Vo) Fireboat (Vo)	12,818

The 2003–2007 emergency response count for the two fire stations (10 and 20) was 36,833. Of those responses, 79.5 percent were EMS incidents, 19.8 percent were fire incidents, and 0.7 percent rescue incidents. When examining travel time reach in the Lake Shore area regardless of responding station, 67 percent of EMS incidents, 62 percent of fire incidents, and 33 percent of rescue incidents were located within a four minute travel time of existing stations; 96 percent of EMS incidents, 93 percent of fire incidents, and 82 percent of rescue incidents were located within an eight minute travel time of existing stations. Map 42 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Lake Shore small planning area averaged 3 minutes 56 seconds with a 90th percentile measure of 6 minutes 55 seconds.

Map 41: Lake Shore Current Coverage



Map 42: Lake Shore Current Incident Coverage

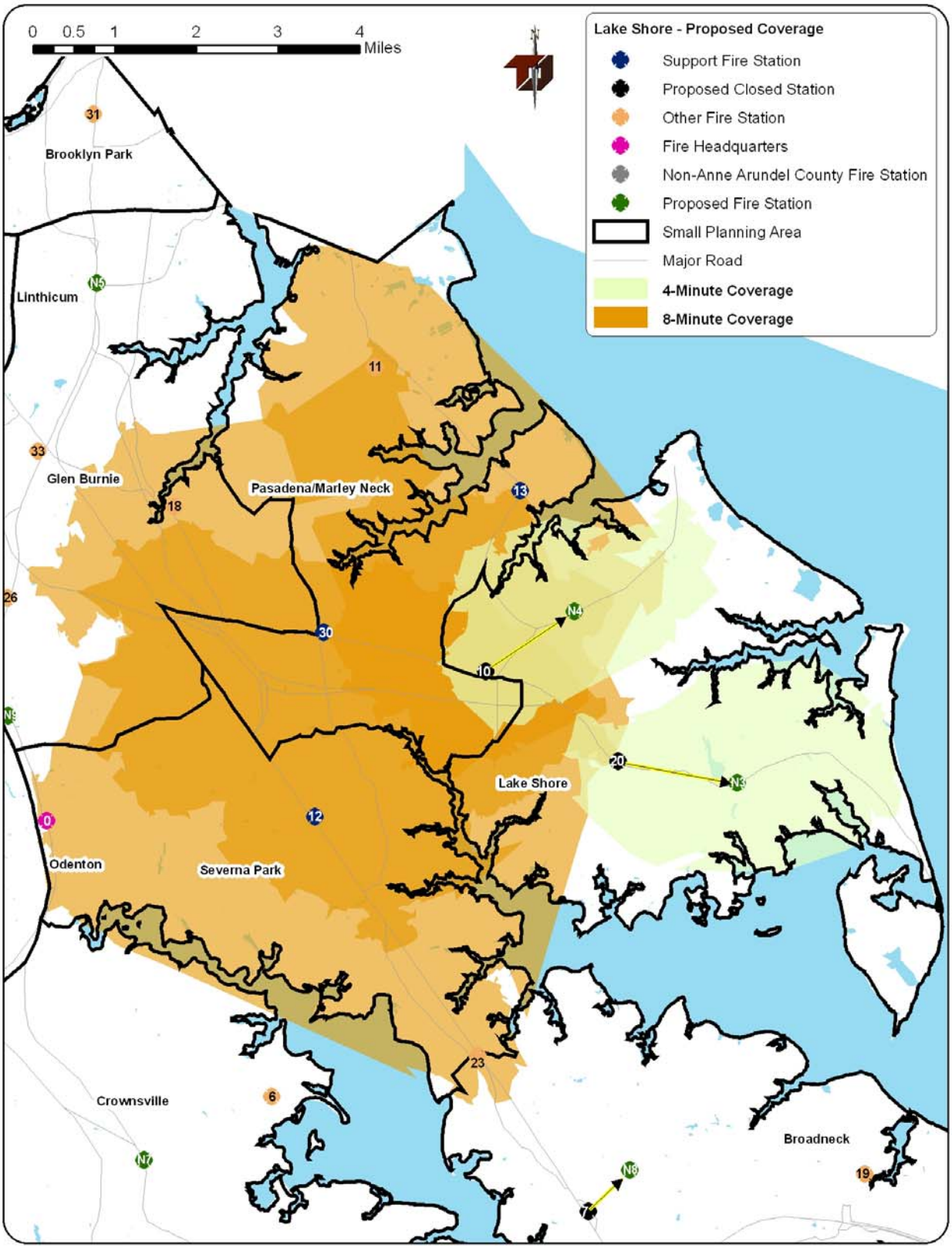


Lake Shore is currently covered by two primary stations—10 and 20. Due to the unique geography of Lake Shore in relation to current station placement as well as the condition of the stations, two new stations are recommended. First, station 10 is in poor condition and requires significant rebuilding. While the site for the current station 10 is adequate given the historical incident density (Map 41), a move to the northeast could provide slightly less overlap with surrounding stations and provide greater reach to the east. The second recommended move is for station 20 which primarily covers the southern fork of Lake Shore. Station 20 is in poor condition as well and has a great deal of overlap with surrounding stations. Additionally, the Gibson Island area at the extreme southeastern end of Lake Shore is experiencing increased travel times due limited access to the area. Moving station 20 the east will reduce the travel time to the Gibson Island area as well as provide more efficient coverage to the Lake Shore area. The combination of these two recommendations yields increased and more efficient coverage. Map 43 shows the proposed coverage for this area. Map 44 shows the proposed incident coverage for Lake Shore. The two changes would increase overall incident coverage from 66 percent to 71 percent at four minutes and from 87 percent to nearly 100 percent at eight minutes.

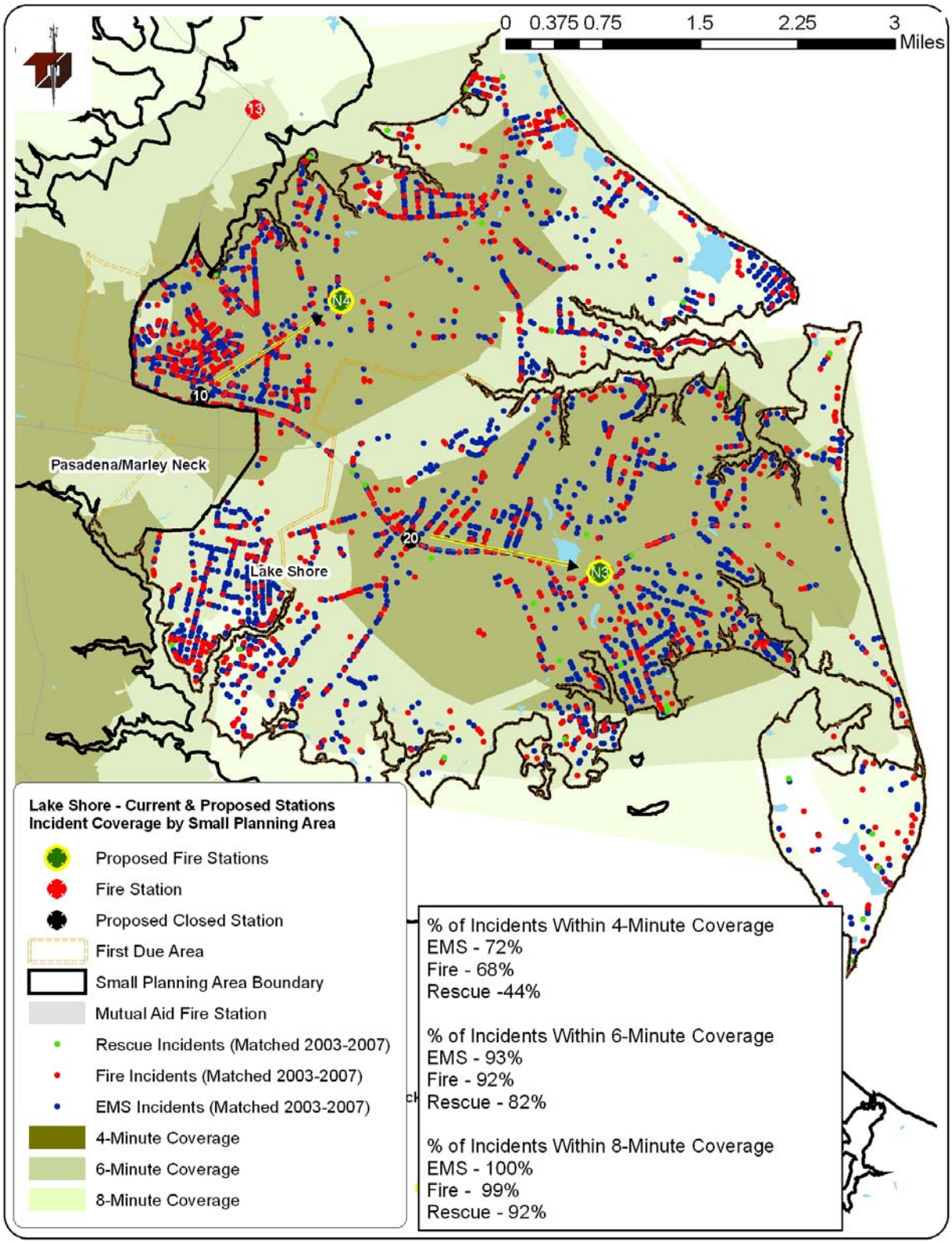
Recommendation 10 (Very High Priority): Close station 20 and build a new station in the vicinity of Forest Glen Drive and Mountain Road.

Recommendation 11 (Low Priority): Close station 10 and build a new station in the vicinity of Fort Smallwood Road and Water Oak Point Road.

Map 43: Proposed Lake Shore Coverage



Map 44: Proposed Lake Shore Incident Coverage



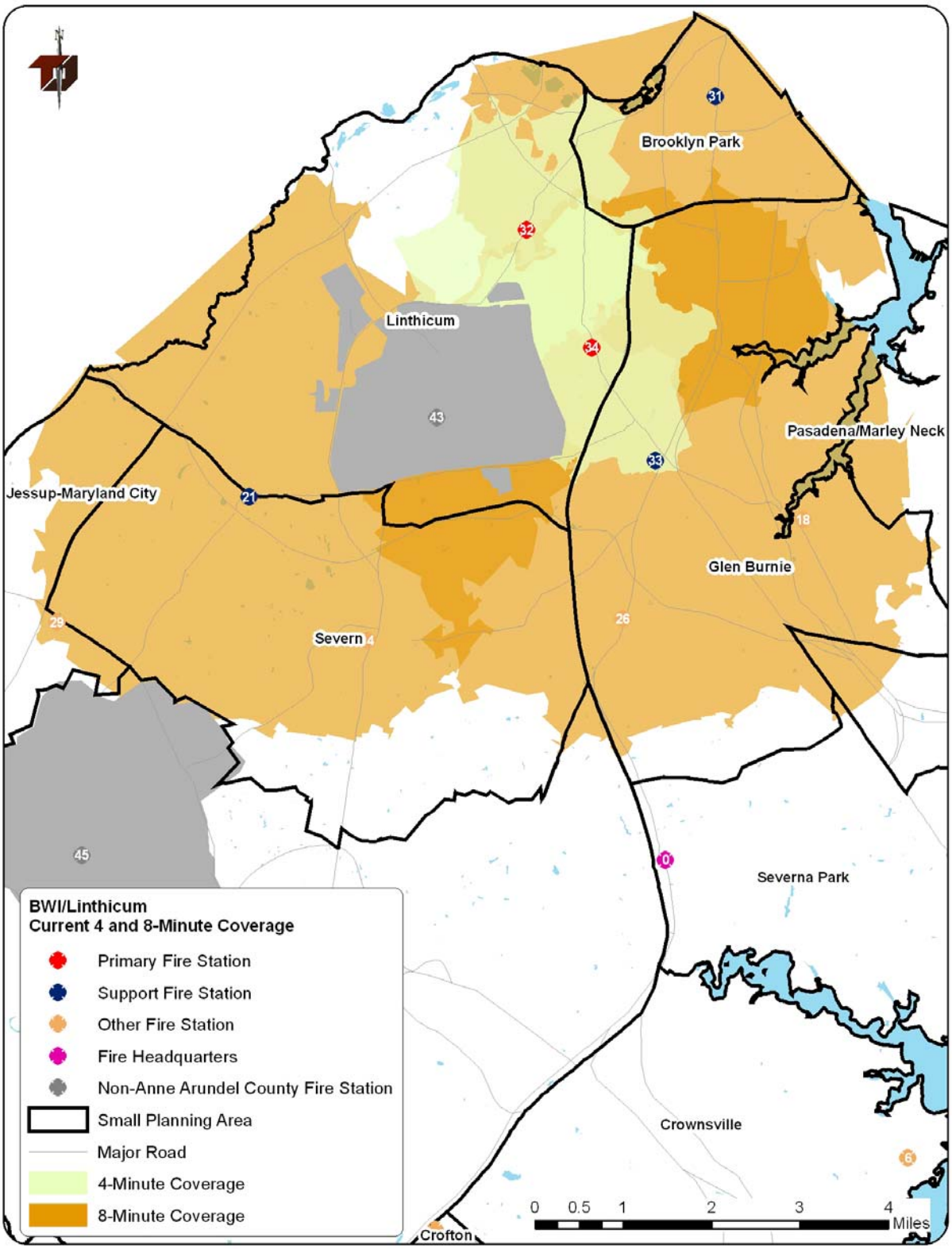
BWI/Linthicum – The Baltimore-Washington International (BWI) Airport Fire Station 43 is located in this area and is excluded from the majority of this analysis. BWI-Linthicum has two primary fire stations located within its limits—stations 32 and 34. Stations 21, 31, and 33 provide service to this area and are considered support stations. Mutual aid is provided by BWI Airport station 43 and Howard County. Table 28 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 45 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 28: BWI/Linthicum Fire Stations

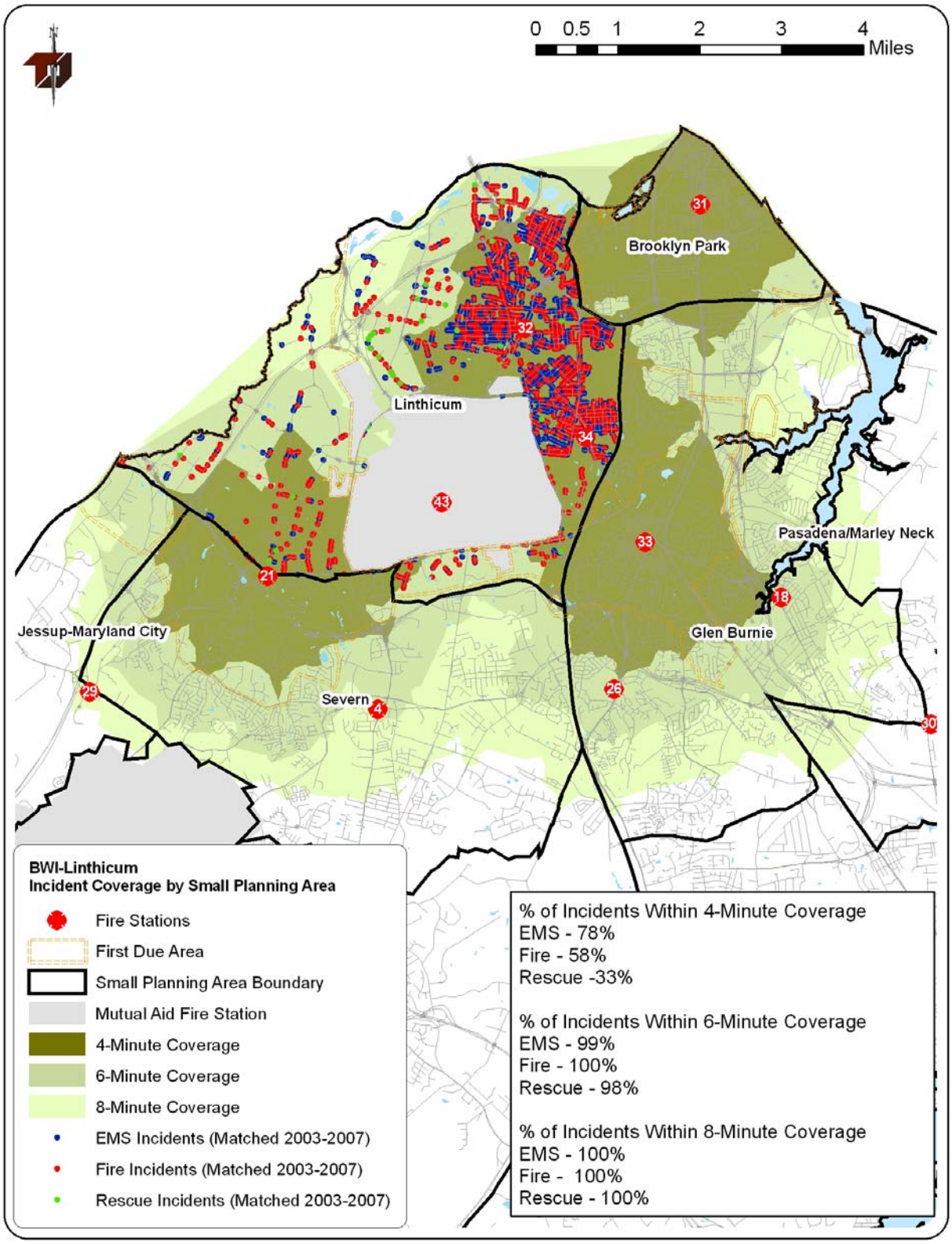
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
32	24 career, 0 volunteer	Engine (Co) Paramedic (Co)	27,028
34	12 career, 42 volunteer	Engine (Co) Engine (Vo) Ambulance (Co) Squad (Vo)	24,763

The 2003–2007 emergency response count for the two fire stations (32 and 34) was 51,791. Of those responses, 80.3 percent were EMS incidents, 18.6 percent were fire incidents, and 1 percent rescue incidents. When examining travel time reach in the BWI/Linthicum area regardless of responding station, 78 percent of EMS incidents, 58 percent of fire incidents, and 33 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 46 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the BWI/Linthicum small planning area averaged 3 minutes 21 seconds with a 90th percentile measure of 5 minutes 24 seconds.

Map 45: BWI/Linthicum Current Coverage

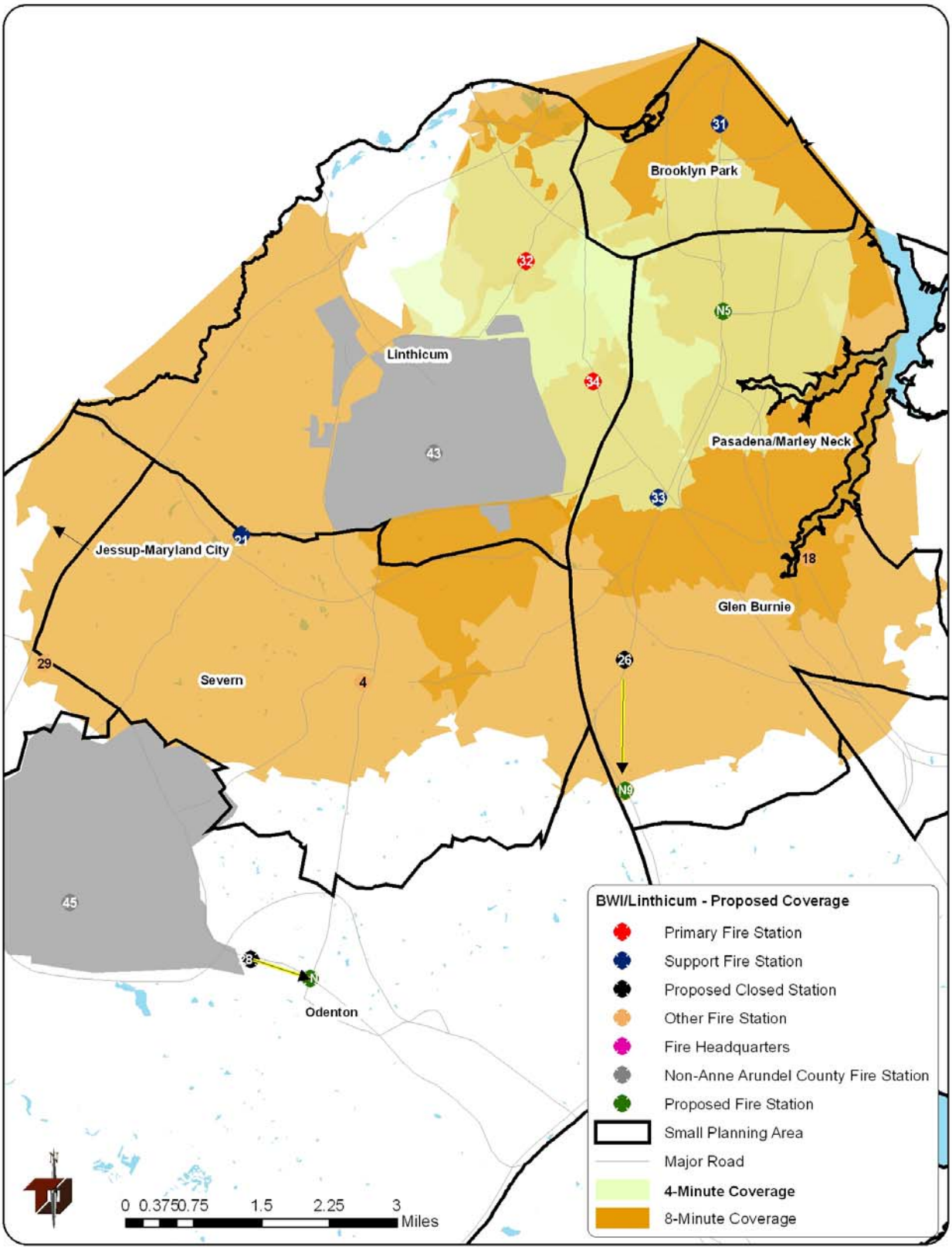


Map 46: BWI/Linthicum Current Incident Coverage

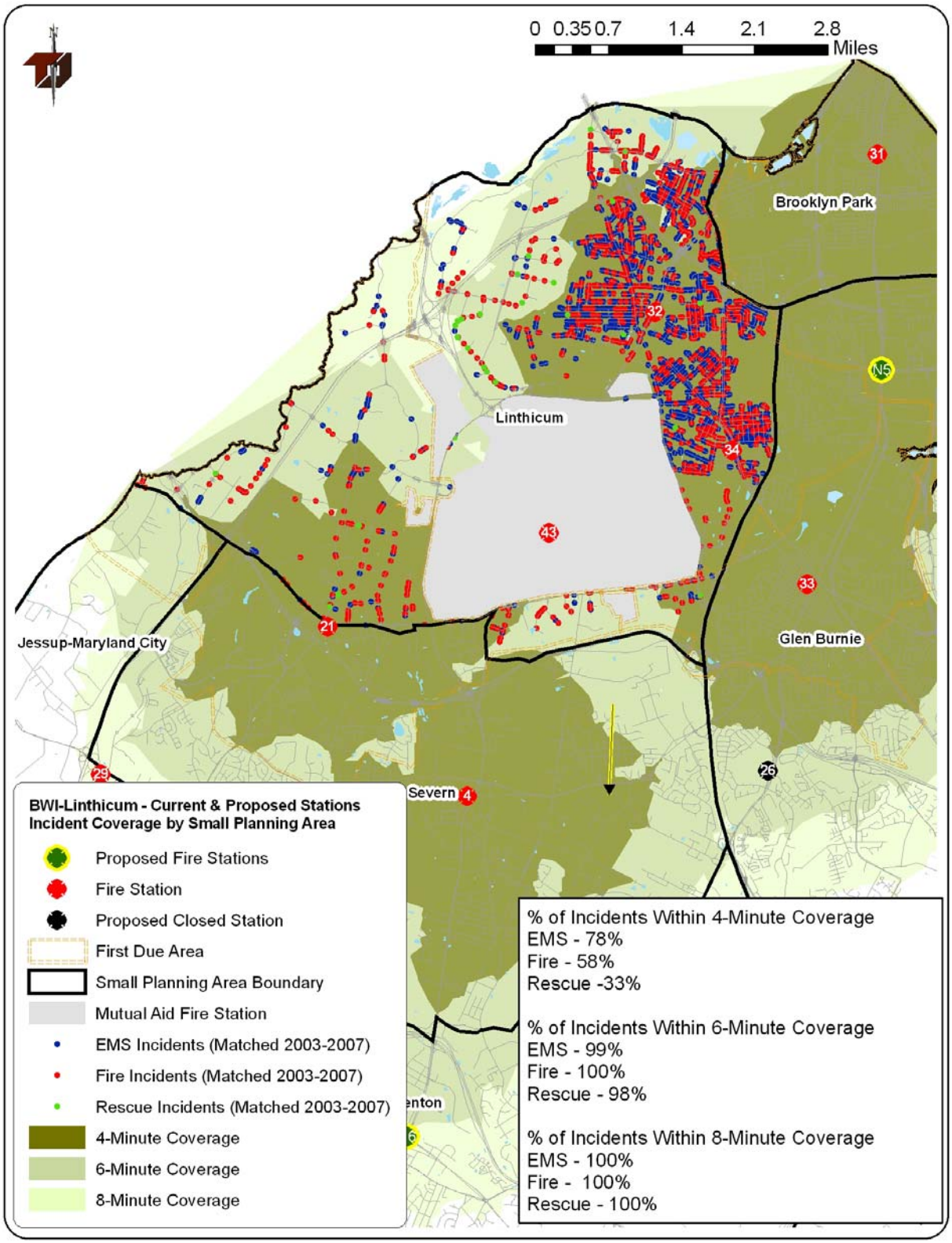


The BWI/Linthicum small planning area has good overall coverage. BWI/Linthicum includes the BWI airport which covers a central part of the area. An earlier recommendation (Glen Burnie, Recommendation 8) describes building a new station 34 slightly to the east into the Glen Burnie small planning area and staffing it with career personnel from existing station 34. Volunteers would remain at the current station 34 in the BWI/Linthicum area. Map 47 and Map 48 show the proposed coverage and proposed incident coverage, respectively. As the current station 34 is located near the border of BWI/Linthicum and Glen Burnie, the move of station 34 does not significantly reduce the coverage to the area.

Map 47: Proposed BWI/Linthicum Coverage



Map 48: Proposed BWI/Linthicum Incident Coverage



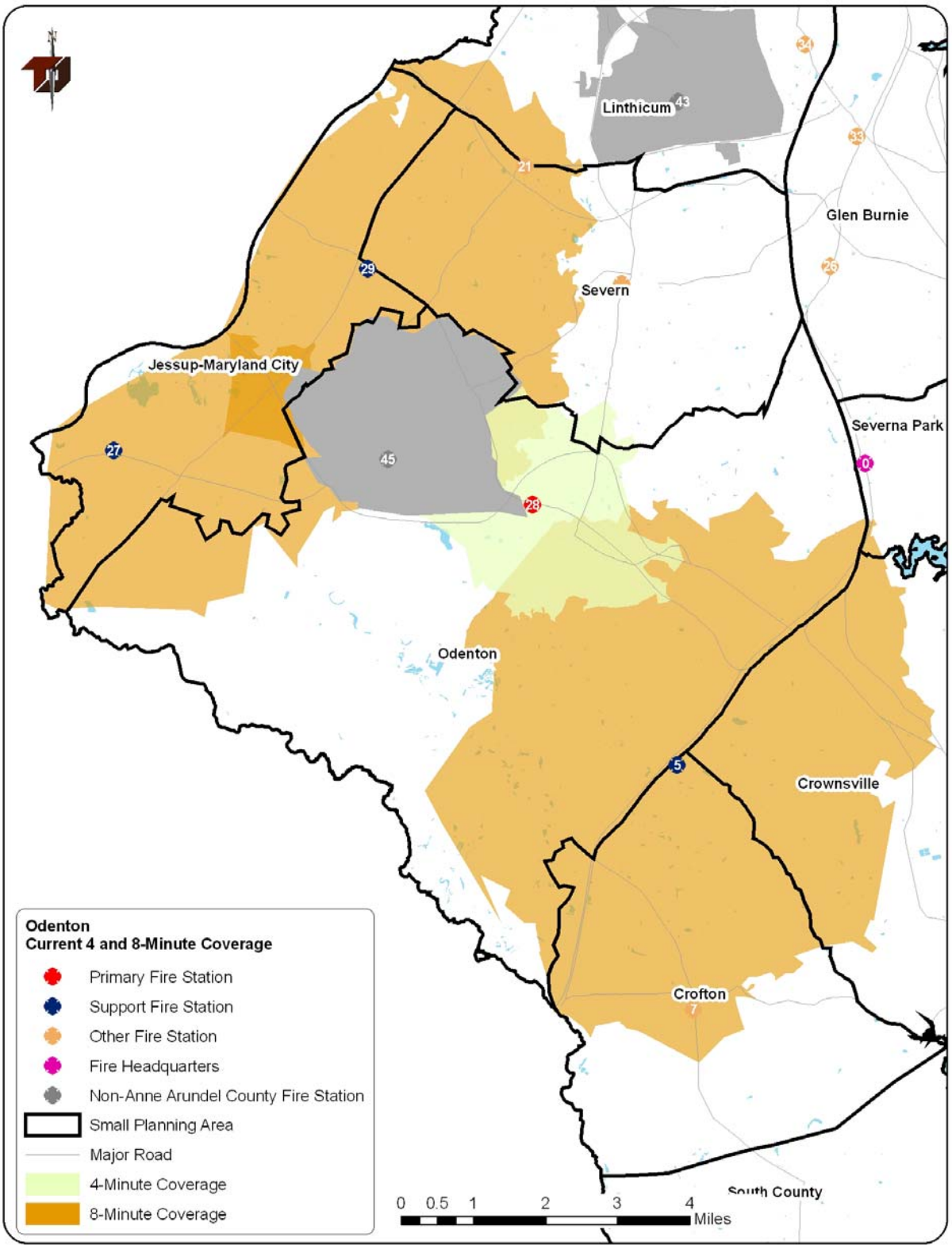
Odenton – Ft. Meade (station 45) is located in this area and is excluded from the majority of this analysis. Odenton has one primary fire station located within its limits—Station 28. Stations 5, 27, and 29 provide service to this area and are considered support stations. Mutual aid is provided by Ft. Meade station 45. Table 29 shows the current apparatus and personnel assigned to the primary fire station with an emergency response count. Map 49 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for the primary station and eight minute theoretical coverage is shown for support stations.

Table 29: Odenton Fire Station

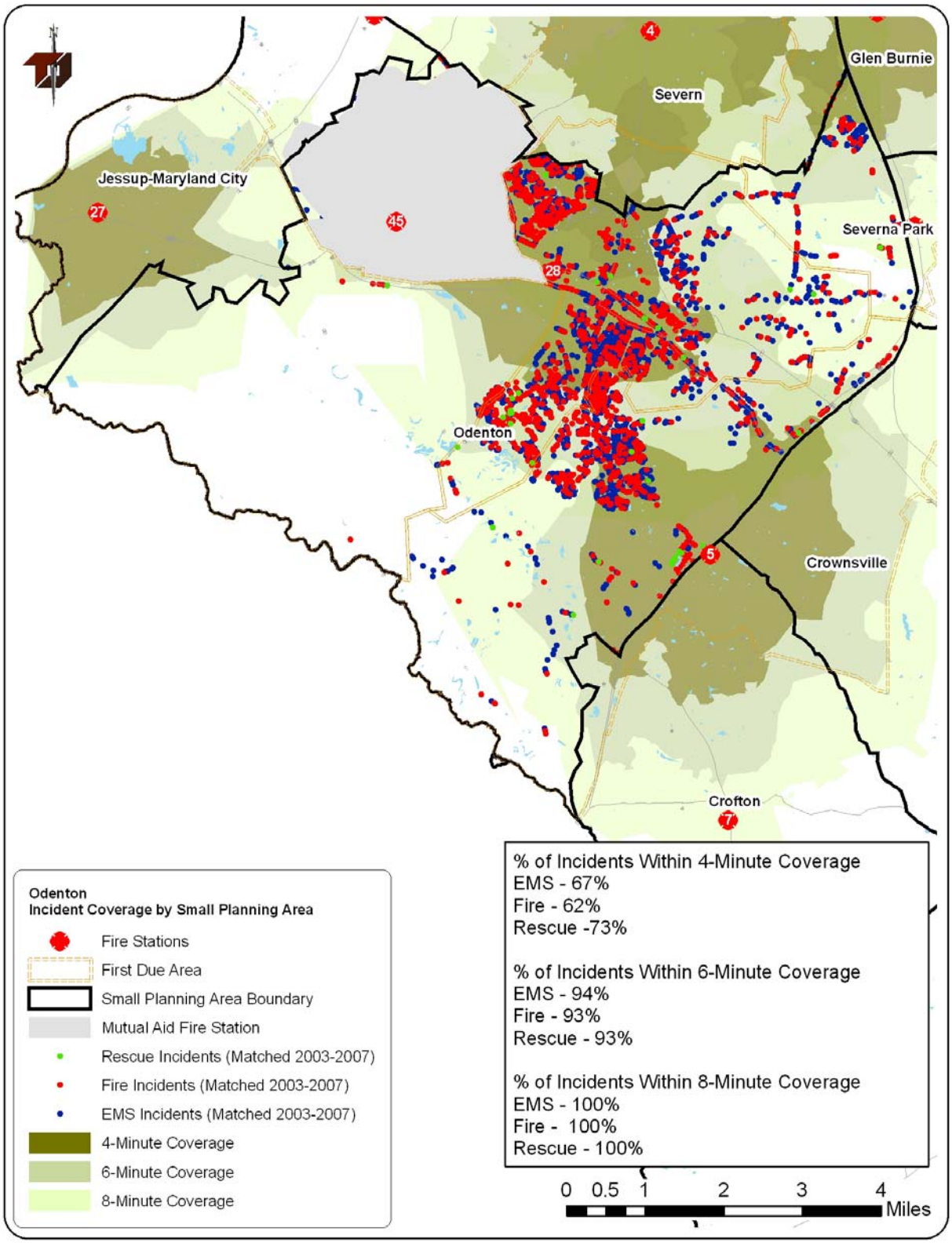
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
28	6 career, 87 volunteer	Ambulance (Co) 2 Engines (Vo) Truck (Vo)	31,011

The 2003–2007 emergency response count for the station 28 was 31,011. Of those responses, 75.7 percent were EMS incidents, 23.7 percent were fire incidents, and 0.5 percent rescue incidents. When examining travel time reach in the Odenton area regardless of responding station, 67 percent of EMS incidents, 62 percent of fire incidents, and 73 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 50 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Odenton small planning area averaged 4 minutes with a 90th percentile measure of 6 minutes 3 seconds.

Map 49: Odenton Current Coverage



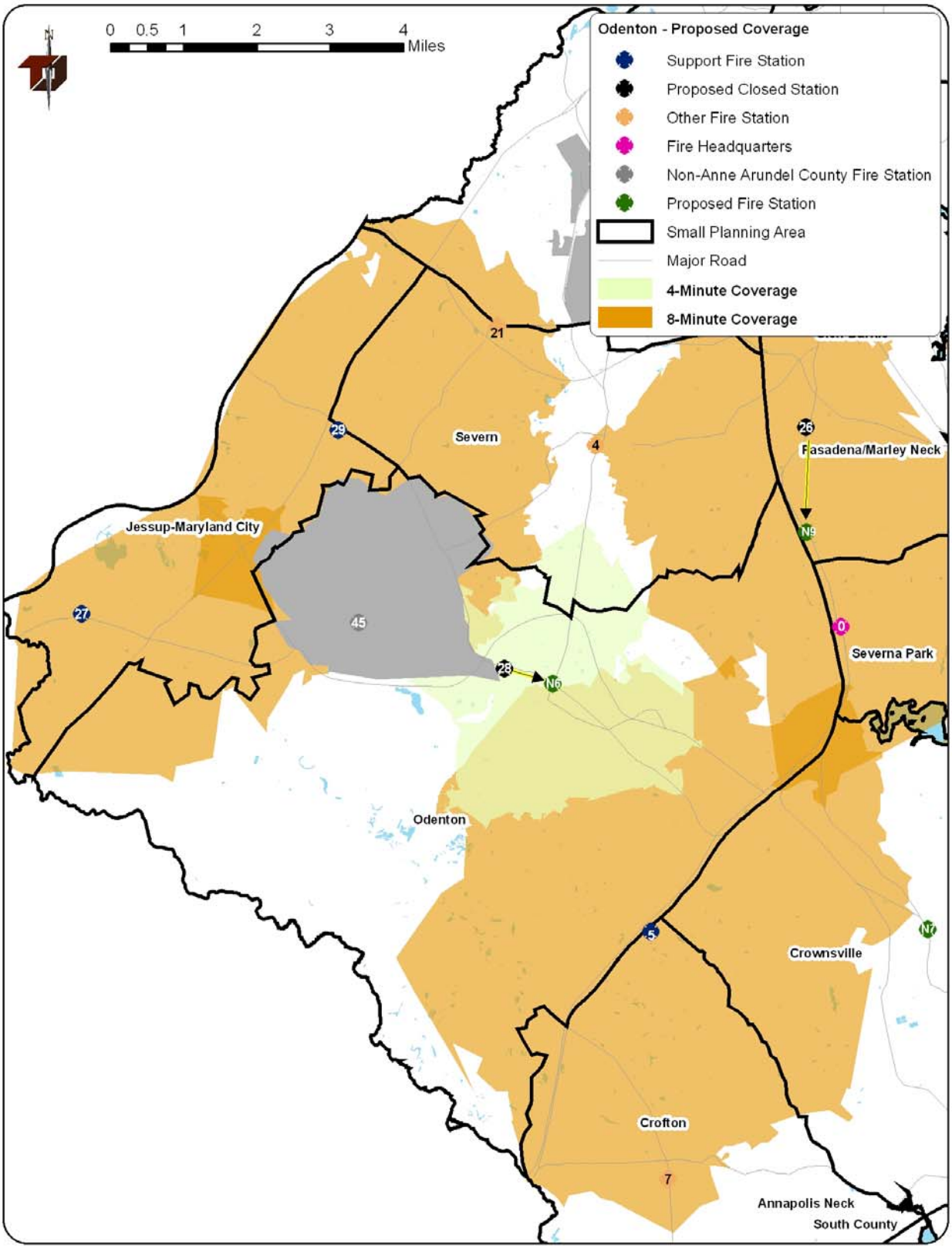
Map 50: Odenton Current Incident Coverage



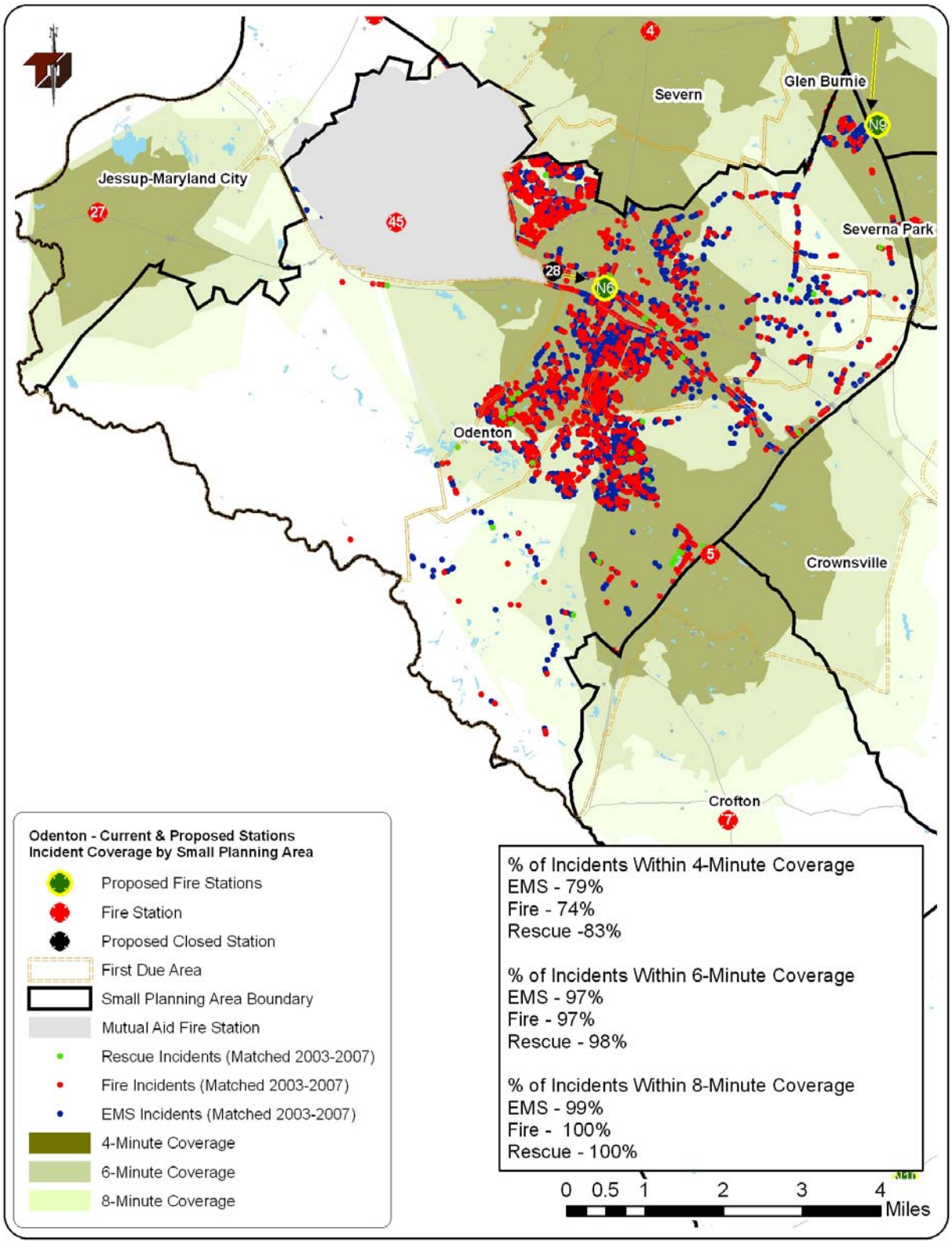
Odenton is a relatively large area with a single station located within the small planning area. Currently, station 28 is located in a high-incident area; however, it is in close proximity to the border of Fort Meade. The station is in marginal condition and needs to be relocated to accommodate Route 175 expansion. To reduce unnecessary coverage of Fort Meade and provide greater coverage to the high incident area, it is recommended to build a new station southeast of its current location. Map 51 and Map 52 show the proposed coverage and proposed incident coverage, respectively.

Recommendation 12 (Moderate Priority): Close station 28 and build a new station (N6) in the vicinity of Annapolis Road/Route 175 and Telegraph Road or just slightly south onto Piney Orchard Parkway.

Map 51: Proposed Odenton Coverage



Map 52: Proposed Odenton Incident Coverage



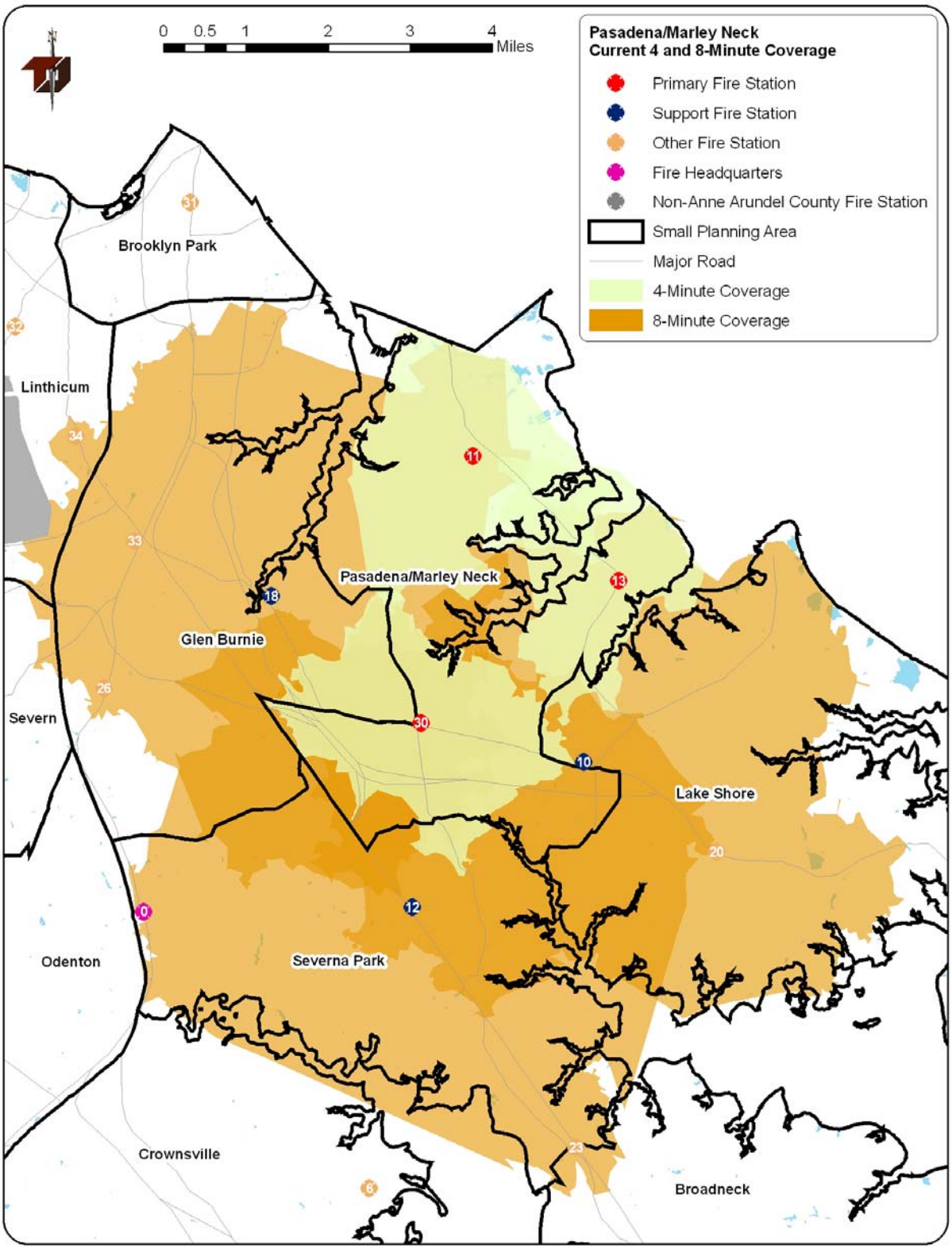
Pasadena/Marley Neck – Pasadena/Marley Neck has three primary fire stations located within its limits—stations 11, 13, and 30. Stations 10, 12, and 18 provide service to this area and are considered support stations. Table 30 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 53 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 30: Pasadena/Marley Neck Fire Stations

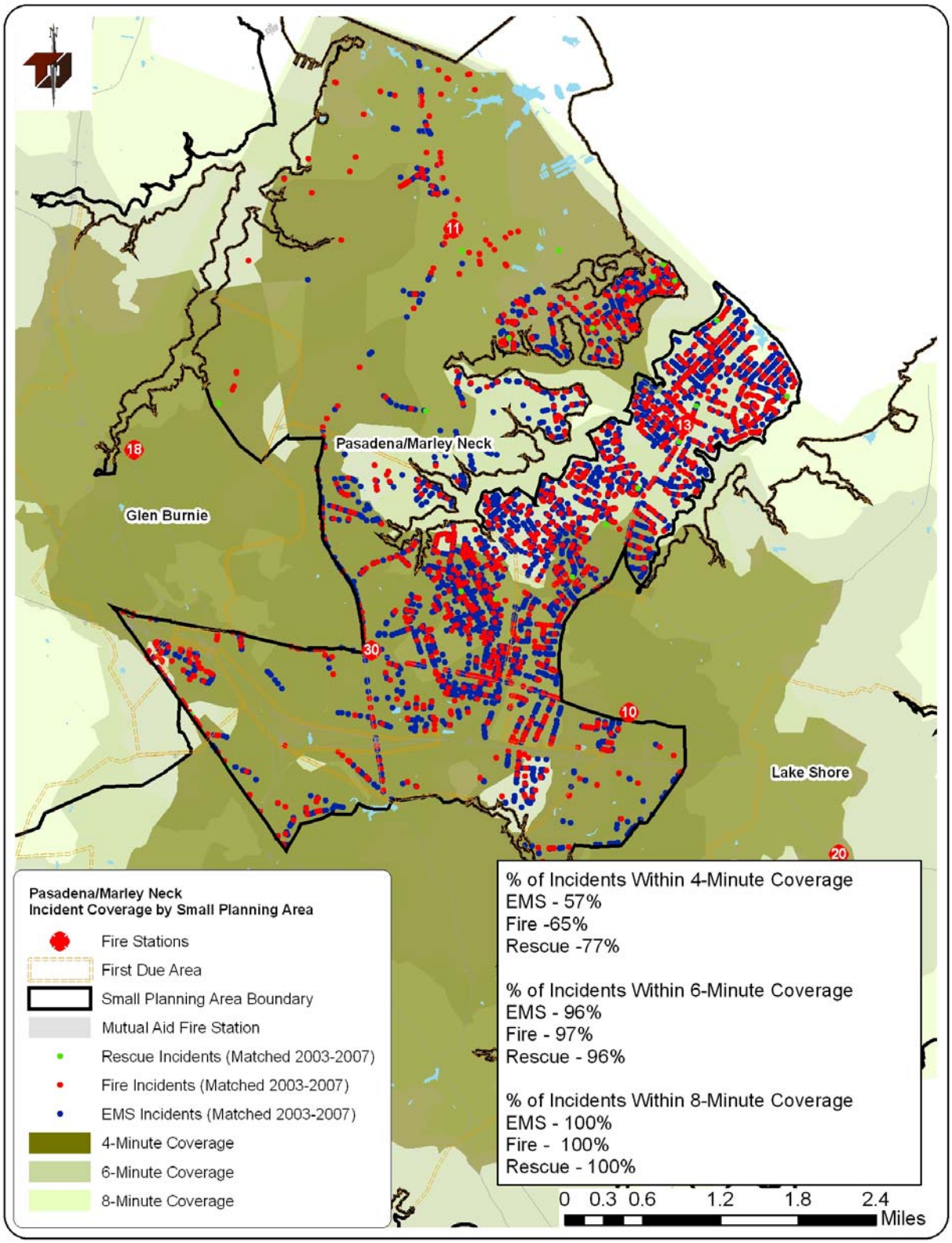
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
11	16 career, 39 volunteer	Ambulance (Co) Engine (Vo) Truck/Tower (Vo) Squad (Vo)	9,701
13	20 career, 39 volunteer	Ambulance (Co) Engine (Vo) Pumper/Tanker (Vo) Quint (Vo) Fireboat (Vo) Squad (Vo)	27,486
30	24 career, 0 volunteer	Quint (Co) Medic (Co)	24,950

The 2003–2007 emergency response count for the three fire stations (11, 13, and 30) was 62,137.Of those responses, 77.8 percent were EMS incidents, 21.2 percent were fire incidents, and 1 percent rescue incidents. When examining travel time reach in the Pasadena/Marley Neck area regardless of responding station, 57 percent of EMS incidents, 65 percent of fire incidents, and 77 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 54 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Pasadena/Marley Neck small planning area averaged 2 minutes 58 seconds with a 90th percentile measure of 4 minutes 50 seconds.

Map 53: Pasadena/Marley Neck Current Coverage

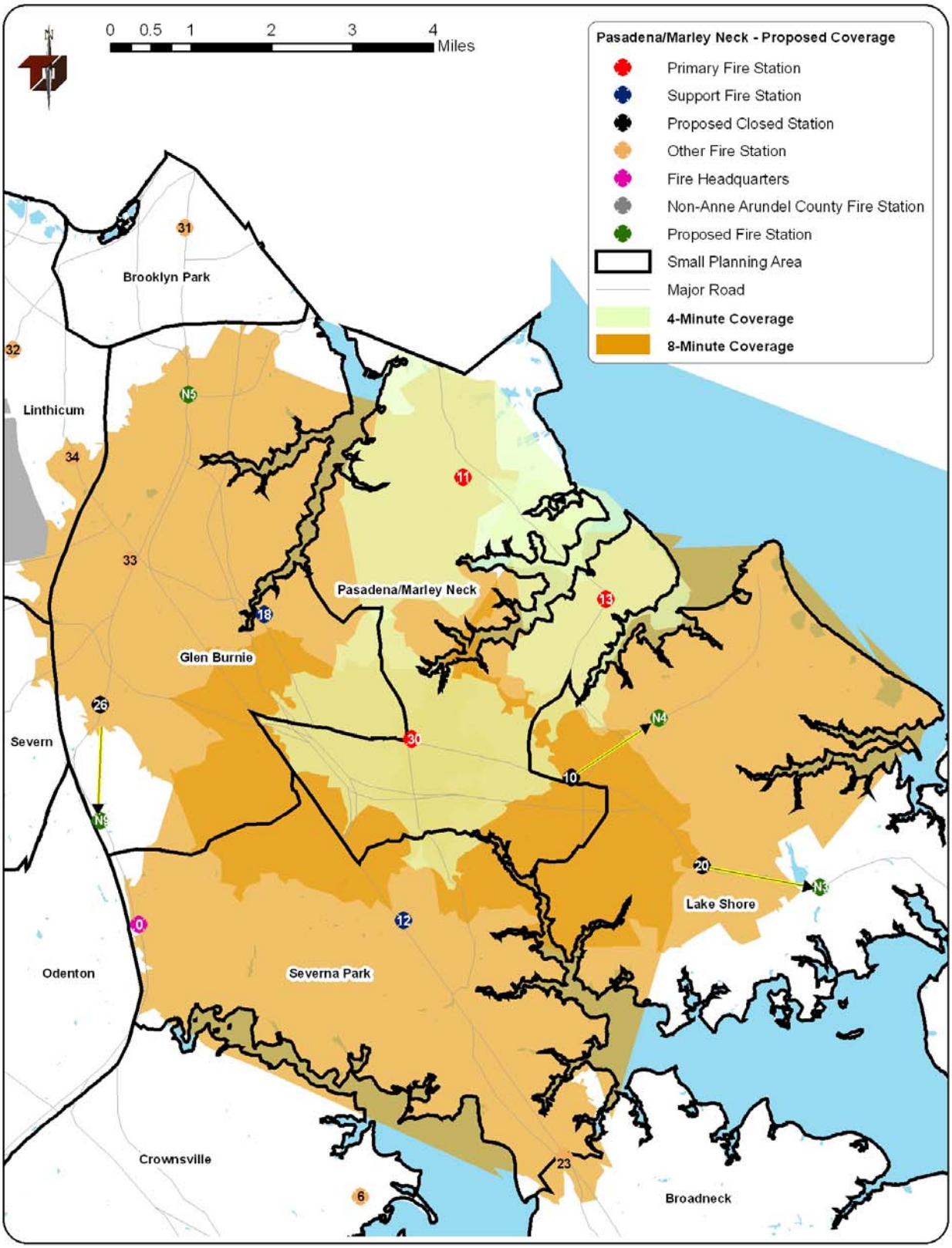


Map 54: Pasadena/Marley Neck Current Incident Coverage

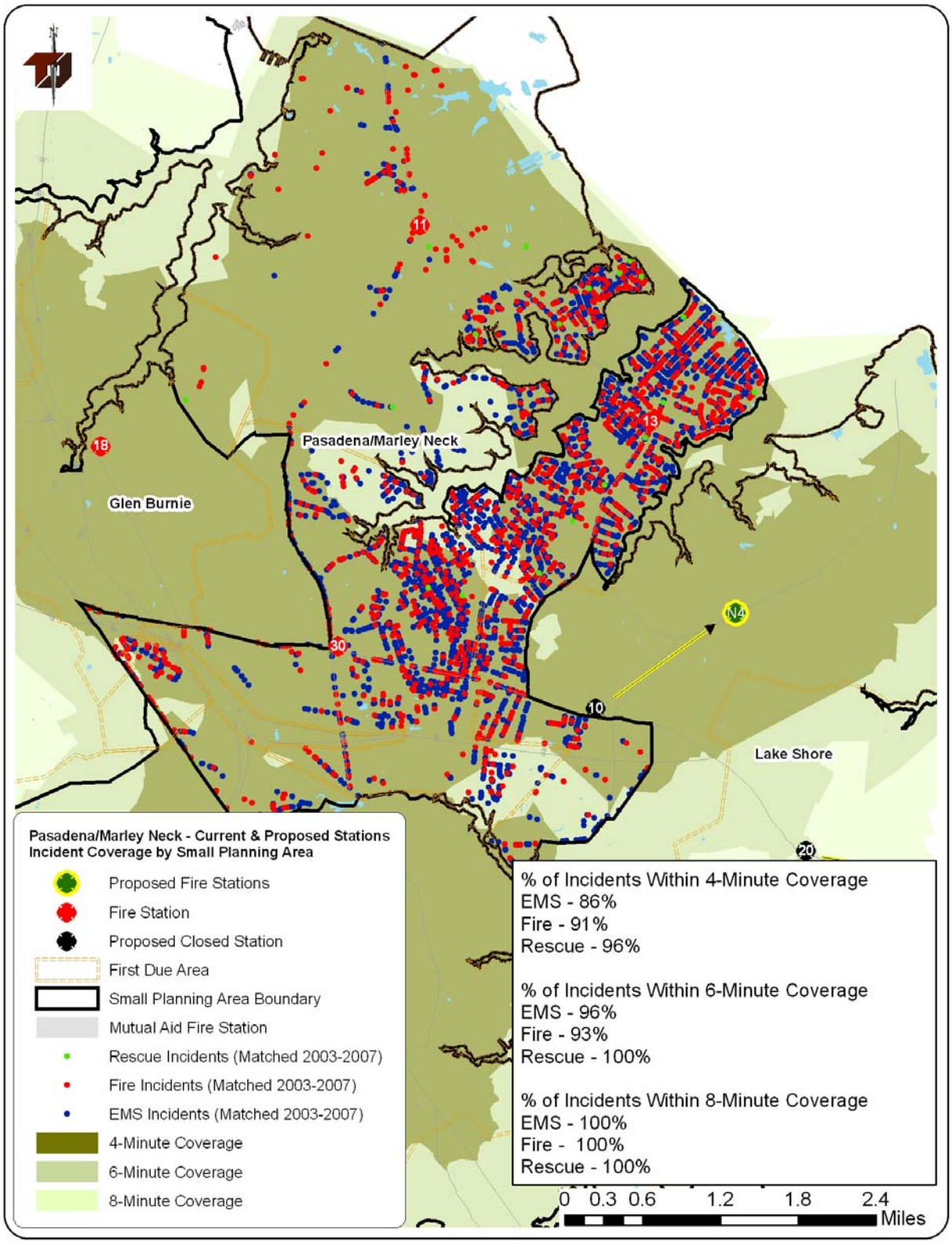


The Pasadena/Marley Neck planning area has good overall coverage. As this is another high-incident area, the overlap in coverage is needed and effective. An earlier recommendation (Lake Shore, Recommendation 11) describes building a new station 10 to the northeast, which increases the four minute coverage in Pasadena/Marley Neck. 86 percent of EMS incidents and 91 percent of fire incidents are now within four minute reach, up from 57 percent for EMS incidents and 65 percent for fire incidents. Map 55 and Map 56 show the proposed coverage and proposed incident coverage, respectively.

Map 55: Proposed Pasadena/Marley Neck Coverage



Map 56: Proposed Pasadena/Marley Neck Incident Coverage



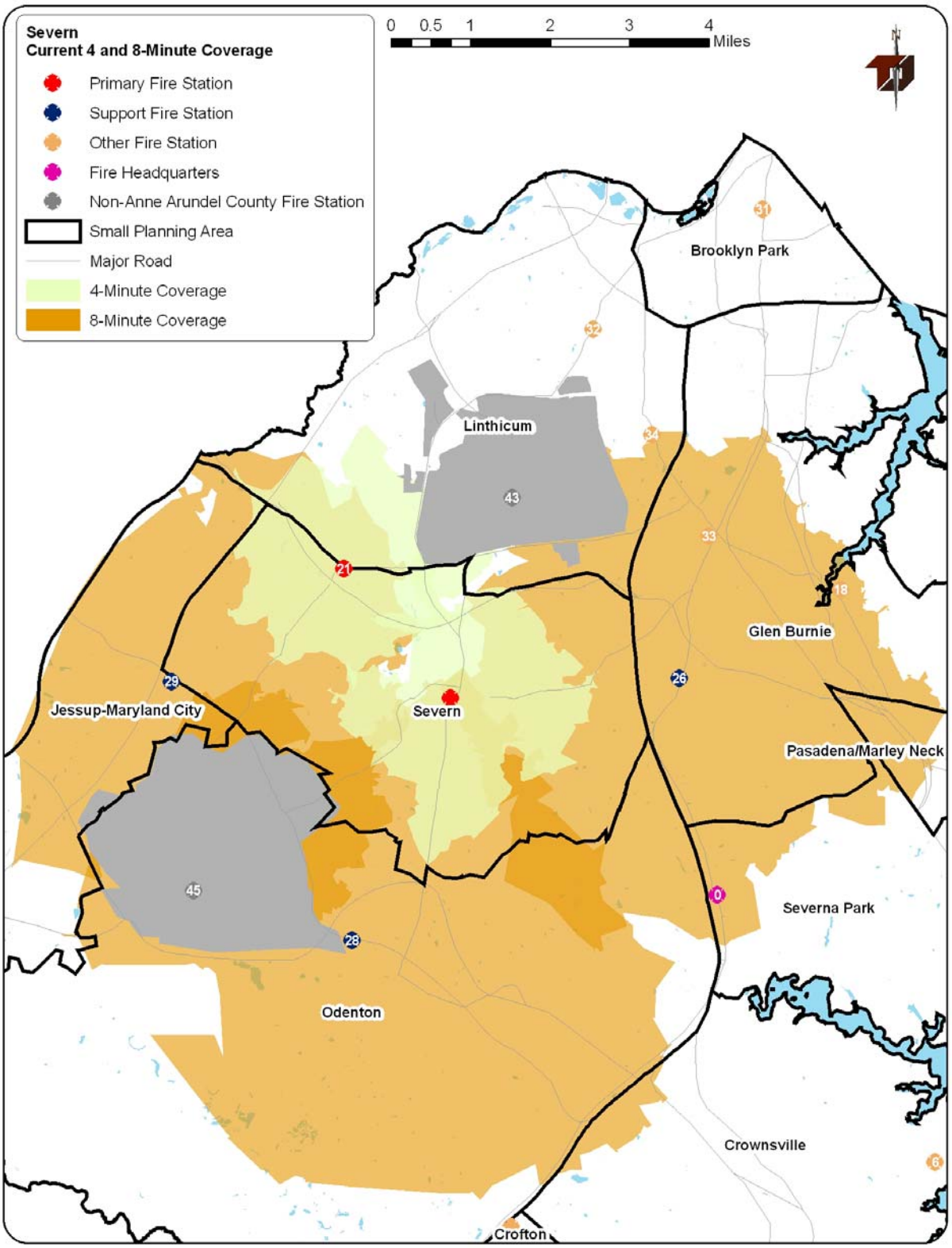
Severn – Severn has two primary fire stations located within its limits—Stations 4 and 21. Stations 26, 28, and 29 provide service to this area and are considered support stations. Mutual aid is provided by BWI Airport station 43. Table 31 shows the current apparatus and personnel assigned to the primary fire stations with an emergency response count. Map 57 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for primary stations and eight minute theoretical coverage is shown for support stations.

Table 31: Severn Fire Stations

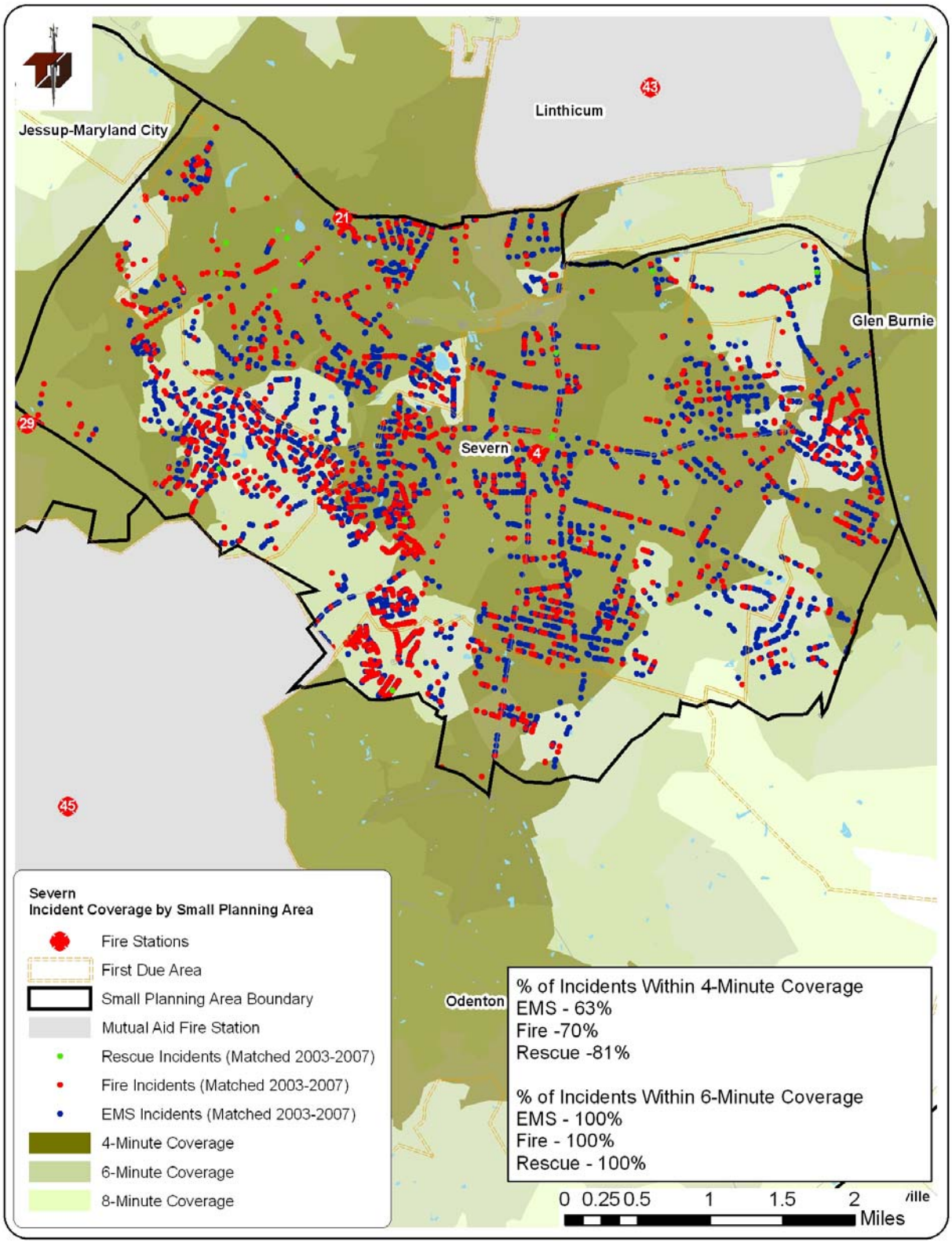
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
4	24 career, 0 volunteer	Quint (Co) Paramedic (Co)	10,690
21	36 career, 0 volunteer	Engine (Co) Paramedic (Co)	22,313

The 2003–2007 emergency response count for the two fire stations (4 and 21) was 33,003. Of those responses, 82.1 percent were EMS incidents, 17 percent were fire incidents, and 0.9 percent rescue incidents. When examining travel time reach in the Severn area regardless of responding station, 63 percent of EMS incidents, 70 percent of fire incidents, and 81 percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 58 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Severn small planning area averaged 3 minutes 44 seconds with a 90th percentile measure of 5 minutes 46 seconds.

Map 57: Severn Current Coverage

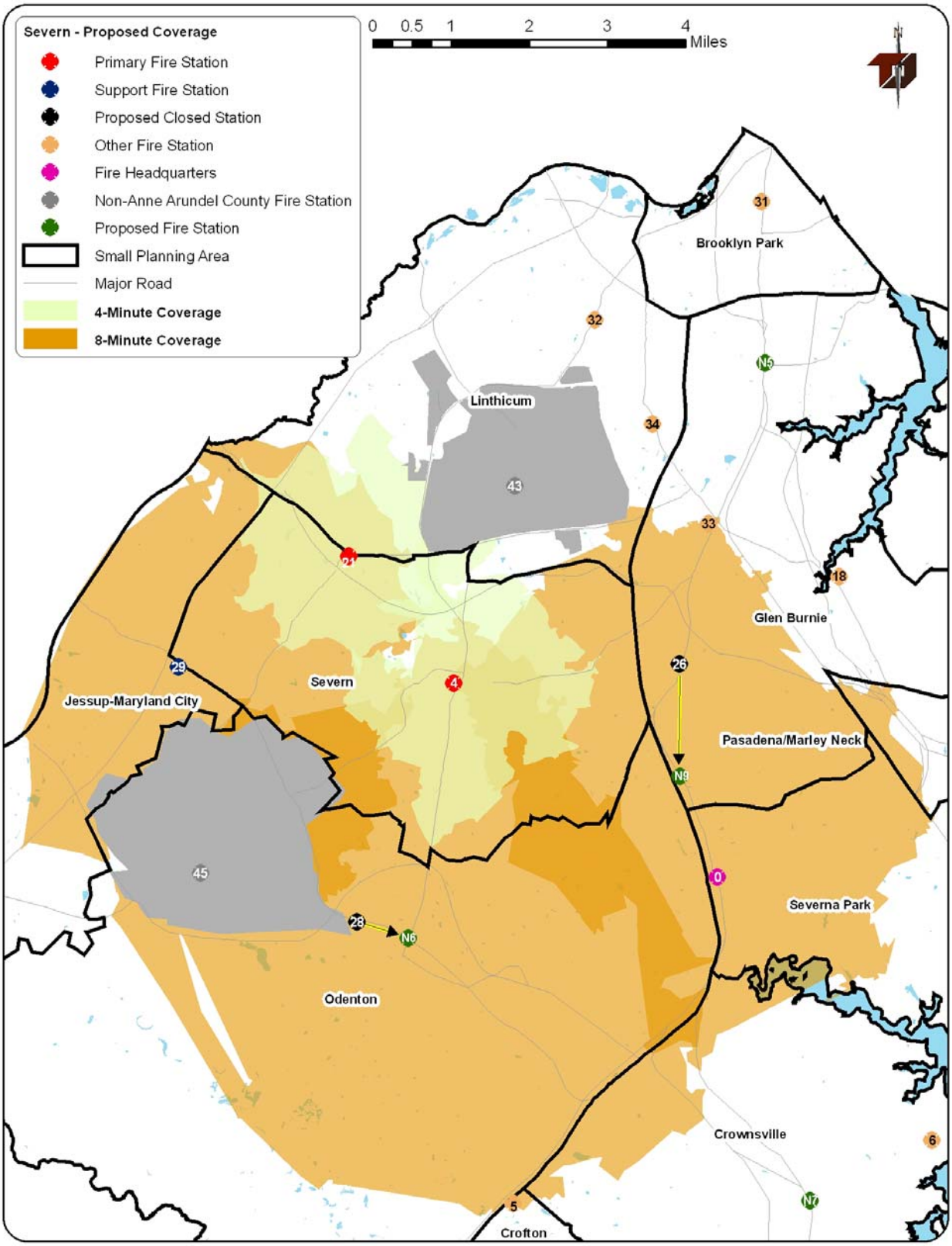


Map 58: Severn Current Incident Coverage

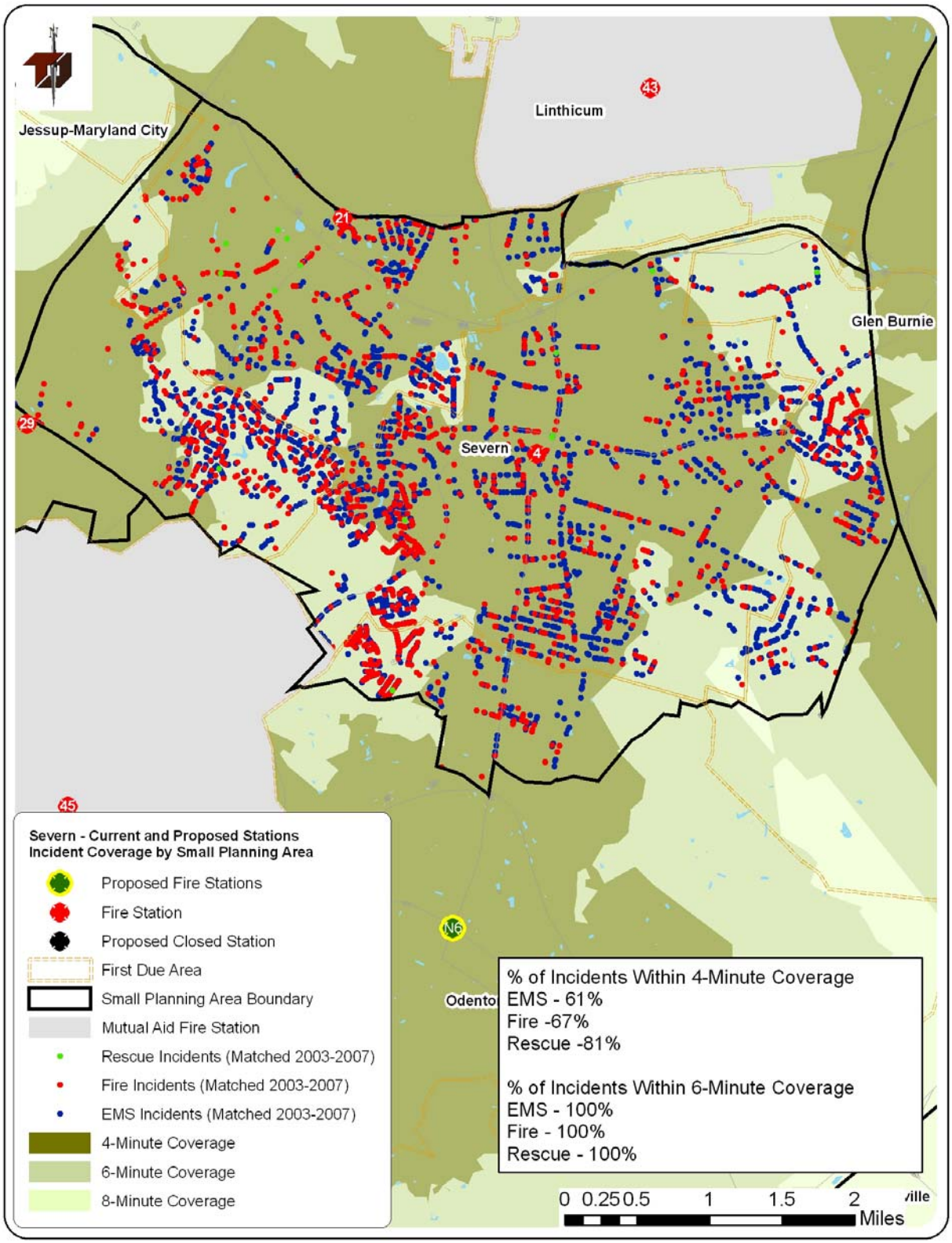


The Severn planning area has good overall coverage. As this is a relatively high-incident area, the overlap in coverage is needed and effective. Two earlier recommendations (Glen Burnie Recommendation 6 and Odenton Recommendation 12) do not significantly reduce overlap coverage to Severn. Map 59 and Map 60 show the proposed coverage and proposed incident coverage, respectively.

Map 59: Proposed Severn Coverage



Map 60: Proposed Severn Incident Coverage



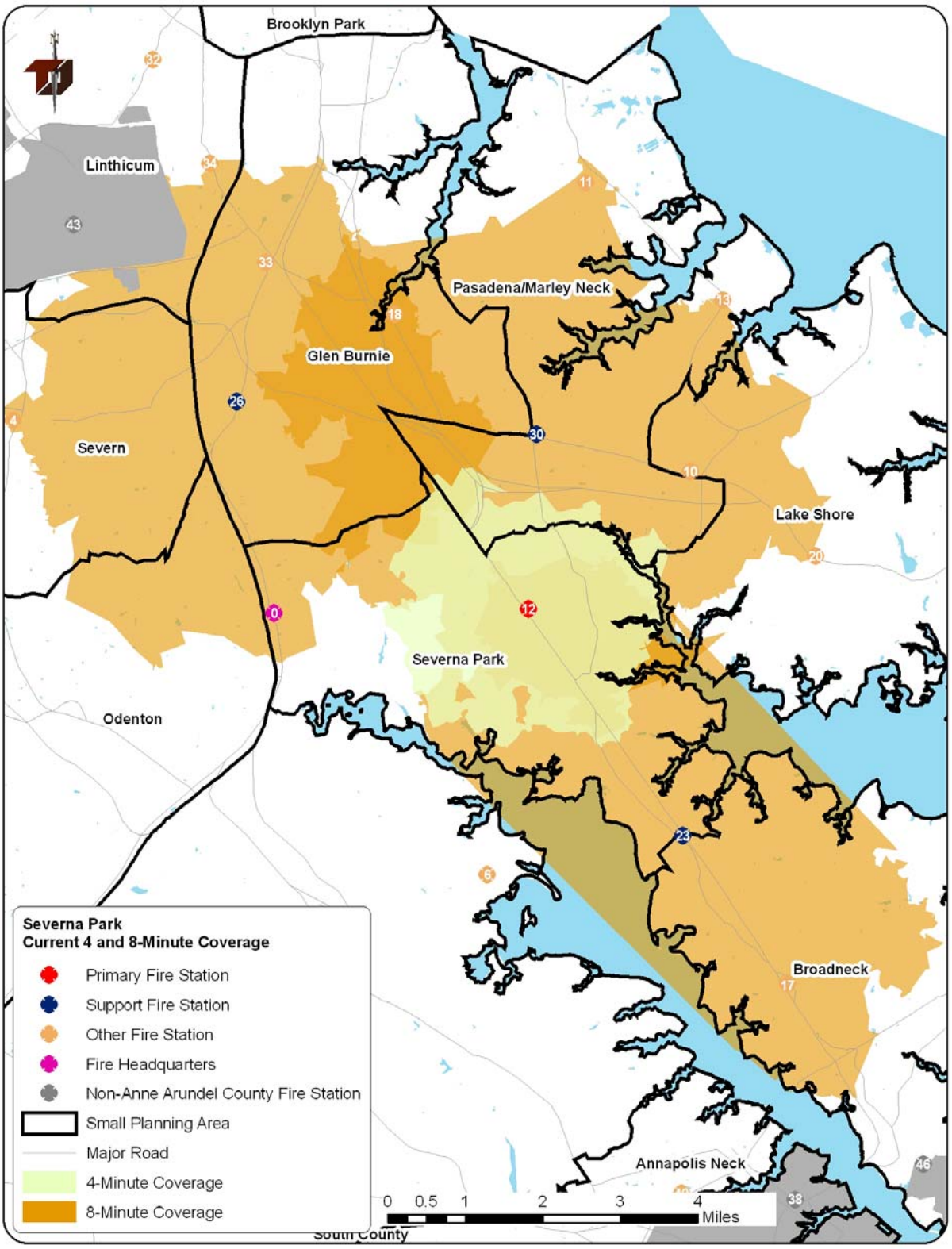
Severna Park – Severna Park has one primary fire station located within its limits—Station 12. Stations 23, 26, and 30 provide service to this area and are considered support stations. Table 32 shows the current apparatus and personnel assigned to the primary fire station with an emergency response count. Map 61 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for the primary station and eight minute theoretical coverage is shown for support stations.

Table 32: Severna Park Fire Station

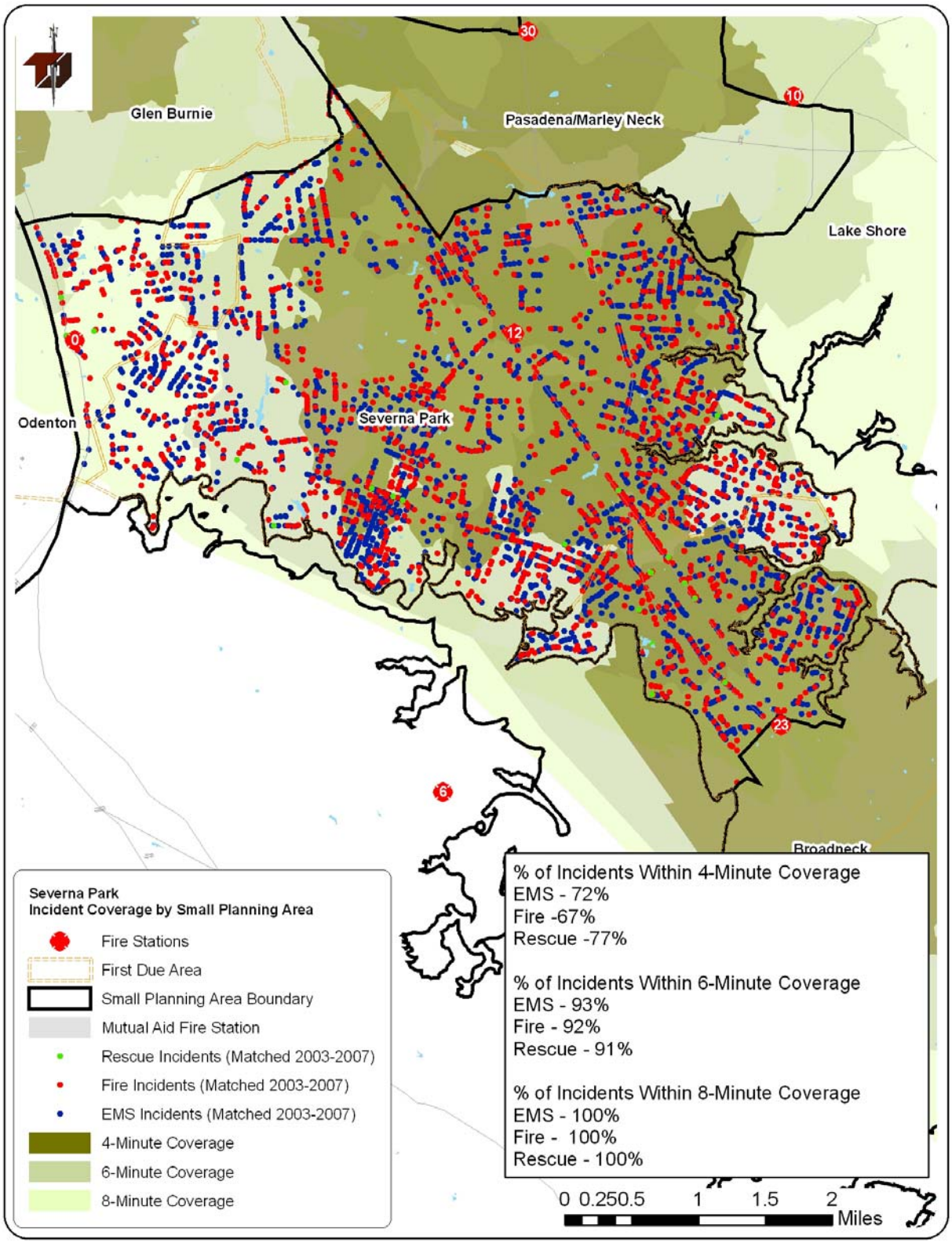
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
12	20 career, 34 volunteer	Paramedic (Co) 2 Engines (Vo) Squad (Vo)	31,063

The 2003–2007 emergency response count for the station 12 was 31,063. Of those responses, 74.2 percent were EMS incidents, 24.9 percent were fire incidents, and 0.8 percent rescue incidents. When examining travel time reach in the Severna Park area regardless of responding station, 72 percent of EMS incidents, 67 percent of fire incidents, and 71percent of rescue incidents were located within a four minute travel time of existing stations; 100 percent of all incidents were located within an eight minute travel time of existing stations. Map 62 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the Severna Park small planning area averaged 4 minutes 1 second with a 90th percentile measure of 6 minutes 26 seconds.

Map 61: Severna Park Current Coverage

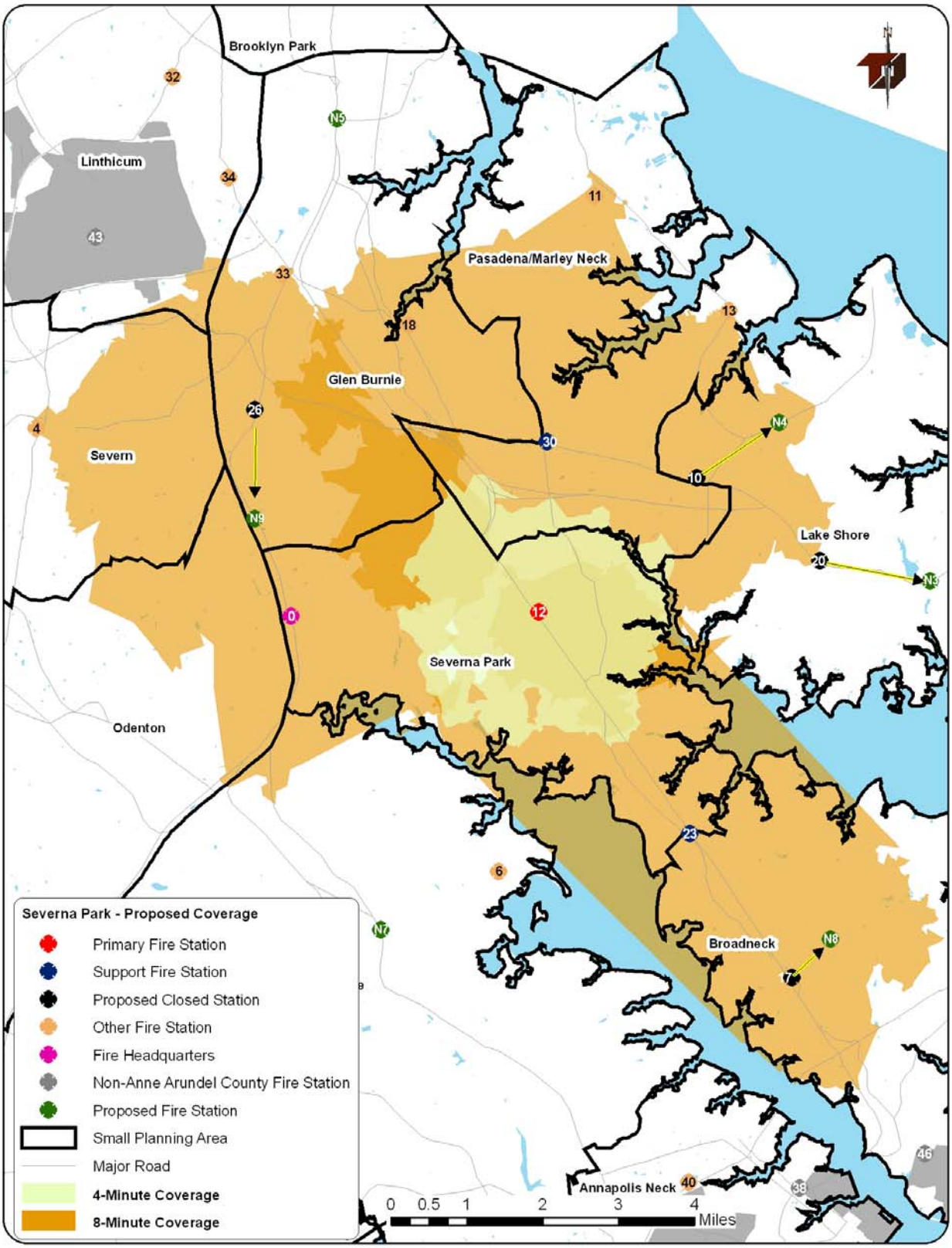


Map 62: Severna Park Current Incident Coverage

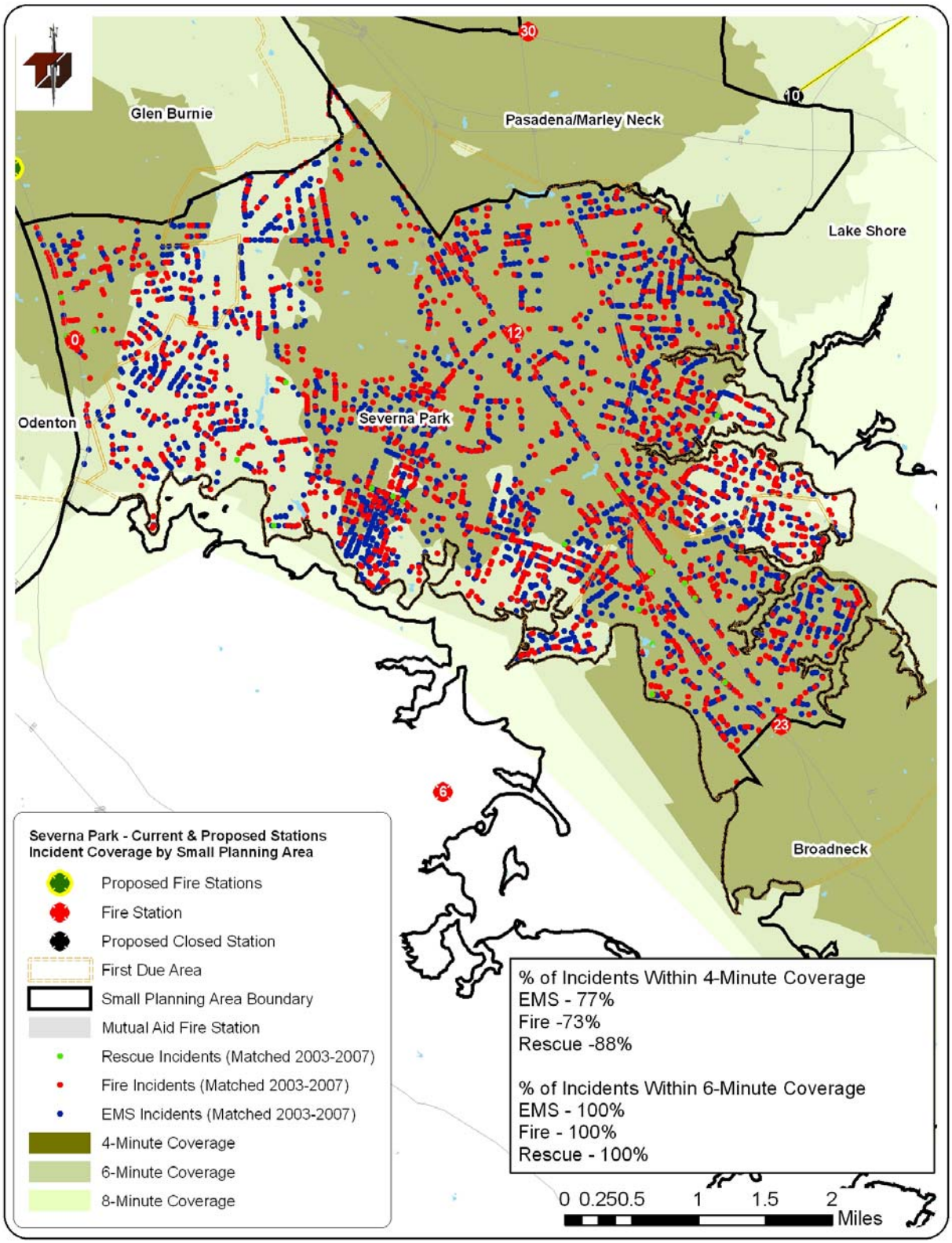


The Severna Park planning area has good overall coverage. As this is another relatively high-incident area, the overlap in coverage is needed and effective. Two earlier recommendations (Glen Burnie Recommendation 6 and Lake Shore Recommendation 11) do not significantly reduce overlap coverage to Severna Park. Map 63 and Map 64 show the proposed coverage and proposed incident coverage, respectively.

Map 63: Proposed Severna Park Coverage



Map 64: Proposed Severna Park Incident Coverage



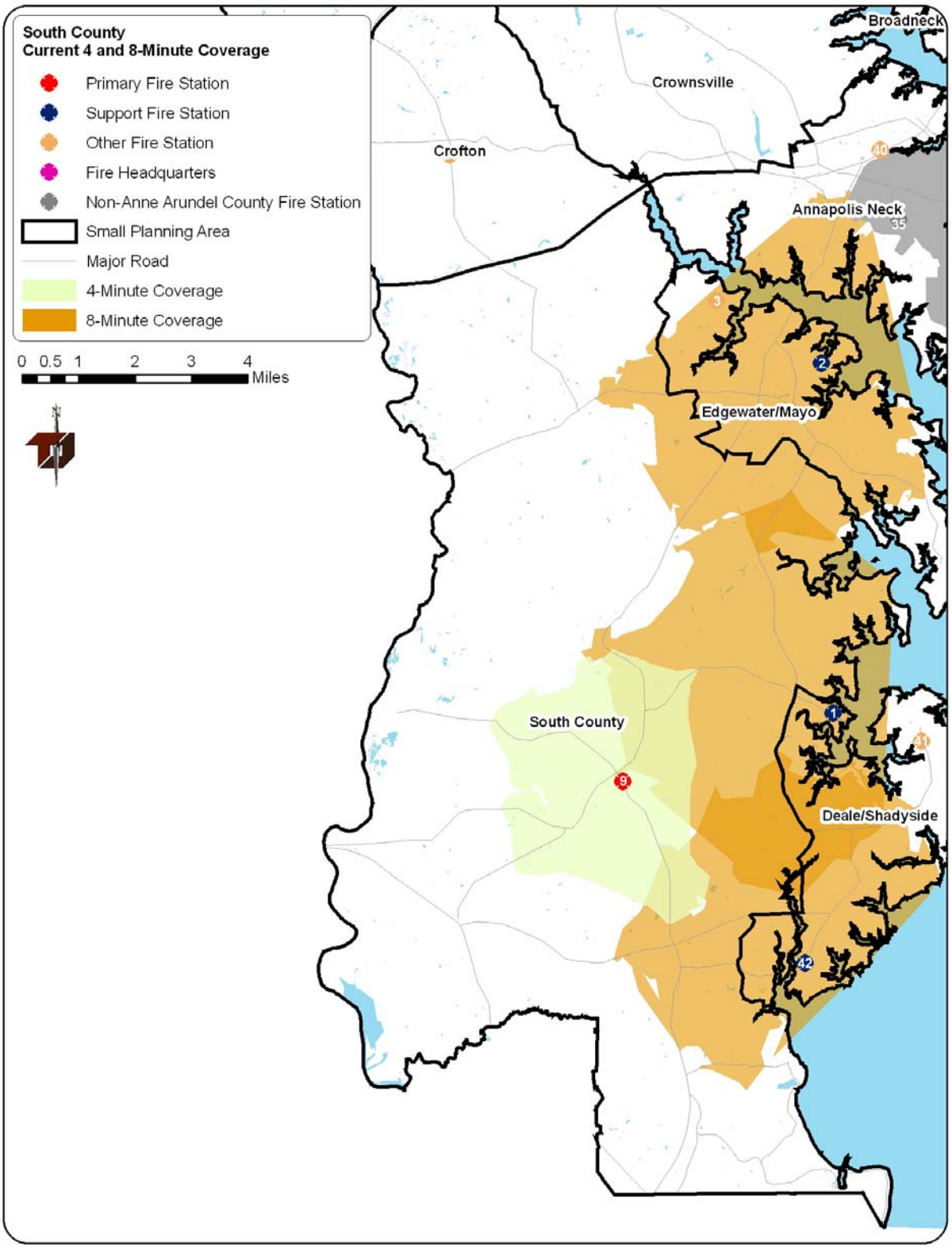
South County – South County has one primary fire station located within its limits—Station 9. Stations 1, 2, and 42 provide service to this area and are considered support stations. Mutual aid is provided by Prince George's County station's 20 and 45 and Calvert County station 5. Table 33 shows the current apparatus and personnel assigned to the primary fire station with an emergency response count. Map 65 provides an overview of the planning area with respect to current coverage. Four minute theoretical coverage is shown for the primary station and eight minute theoretical coverage is shown for support stations.

Table 33: South County Fire Station

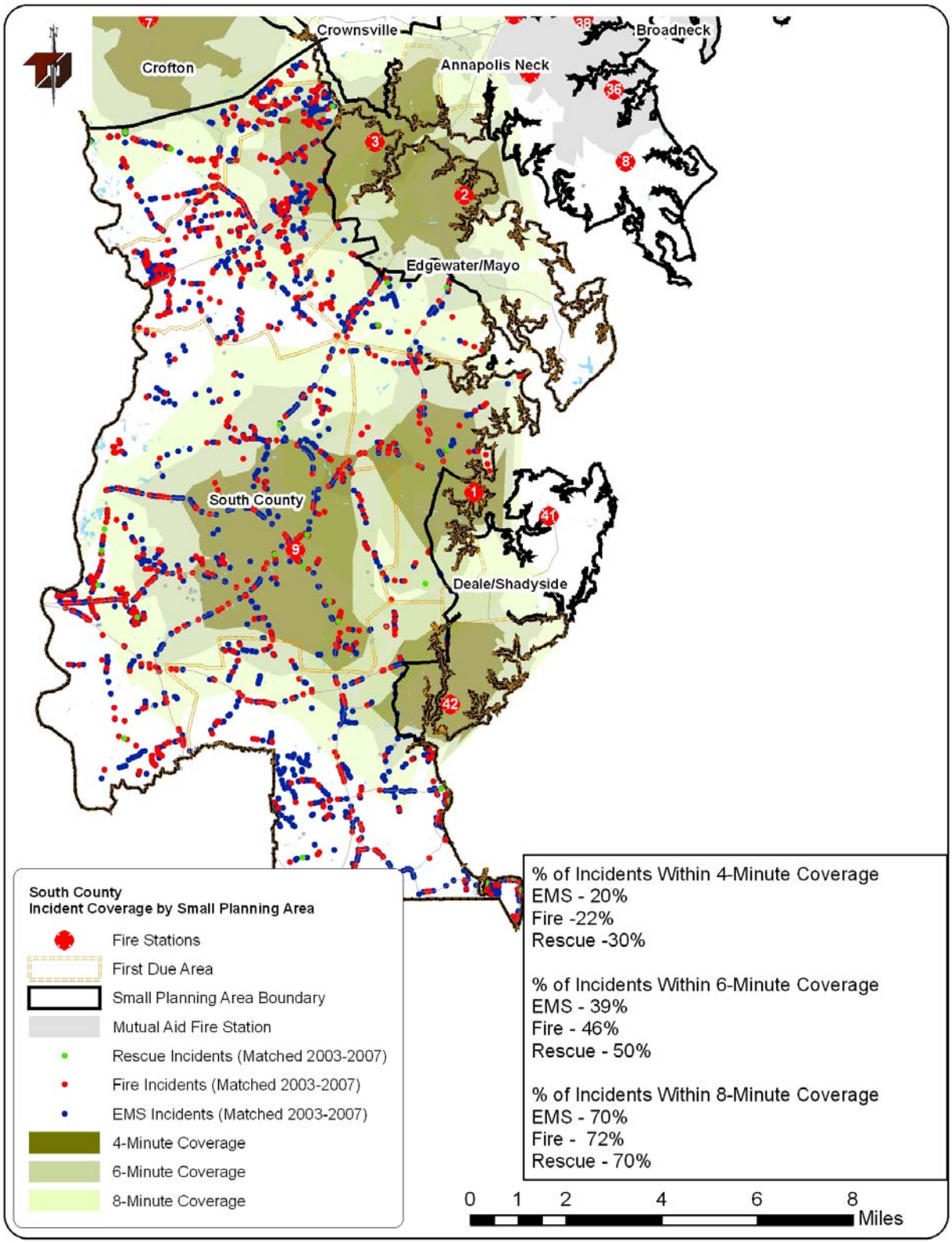
Station	Personnel	Primary Apparatus	2003–2007 Emergency Response Count
9	20 career, 0 volunteer	Pumper/Tanker (Co) Paramedic (Co)	14,311

The 2003–2007 emergency response count for station 9 was 14,311. Of those responses, 80.5 percent were EMS incidents, 18.9 percent were fire incidents, and 0.7 percent rescue incidents. When examining travel time reach in the South County area regardless of responding station, 20 percent of EMS incidents, 22 percent of fire incidents, and 30 percent of rescue incidents were located within a four minute travel time of existing stations; 70 percent of EMS incidents, 72 percent of fire incidents, and 70 percent of rescue incidents were located within an eight minute travel time of existing stations. Map 66 illustrates the current incident coverage for 2003 through 2007 incidents. Overall, travel times within the South County small planning area averaged 6 minutes 45 seconds with a 90th percentile measure of 10 minutes 1 second.

Map 65: South County Current Coverage



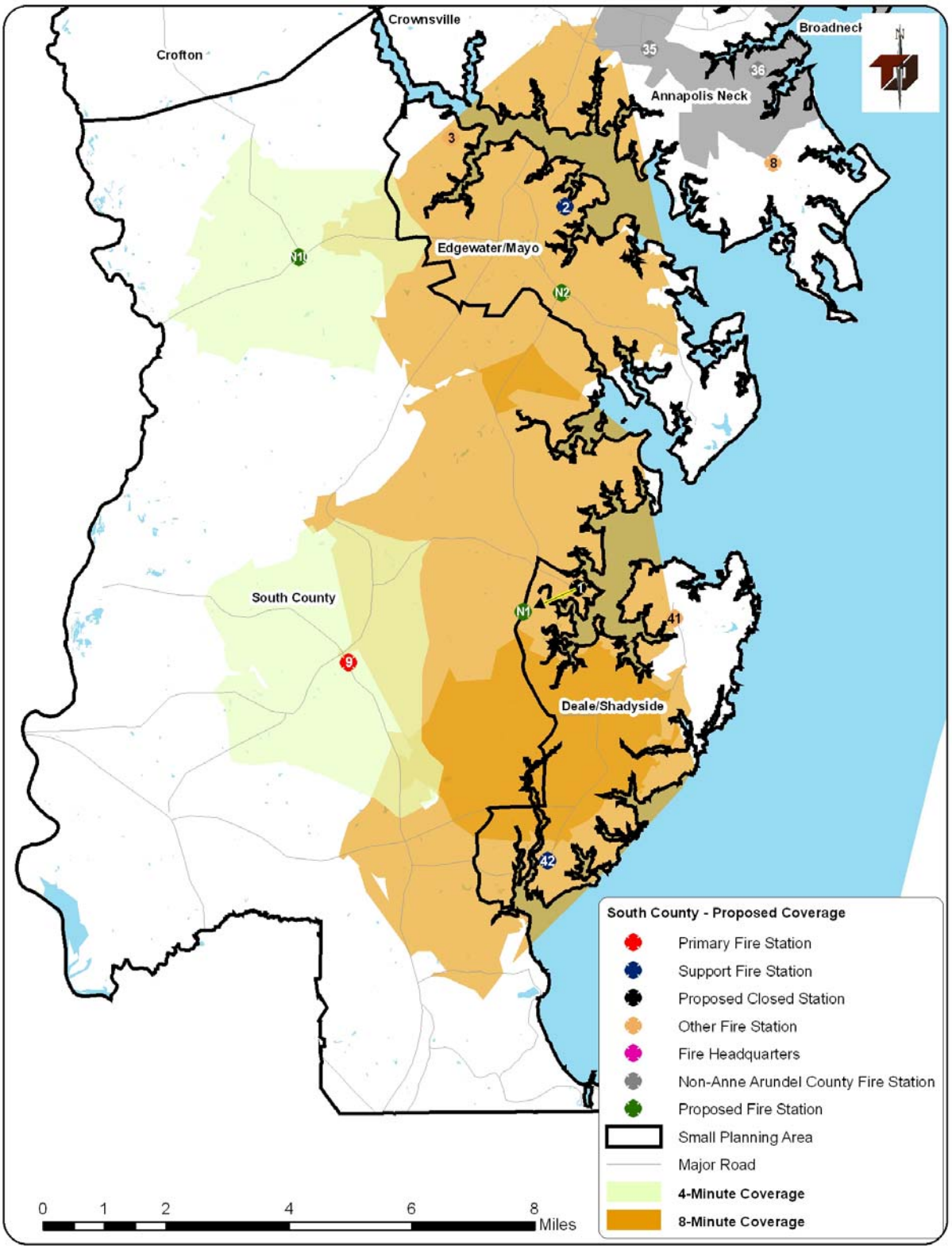
Map 66: South County Current Incident Coverage



South County is by far the largest small planning area in Anne Arundel County. There is one station currently located in South County. This area is mostly rural with few major roads and incidents are fairly well-dispersed throughout South County. Station 9 is located in a central location in relation to the small planning area; however, due to the geography of the area, an additional station in the northern section may be of benefit. This new station will not only provide needed coverage to South County, but provide better support to surrounding areas of Crofton, Edgewater/Mayo and Crownsville. In addition to this new station, the new station N1 (Deale/Shadyside, Recommendation 4) will also provide increased support to South County from its new location. Map 67 shows the proposed coverage for South County and Map 68 shows the proposed incident coverage. The combination of these recommendations is calculated to increase incident coverage from 20 percent to 34 percent at four minutes, 40 percent to 56 percent at six minutes, and 70 percent to 79 percent at eight minutes.

Recommendation 13 (Moderate Priority): Build a new station in the vicinity of Davidsonville Road and Central Avenue.

Map 67: Proposed South County Coverage



Map 68: Proposed South County Incident Coverage

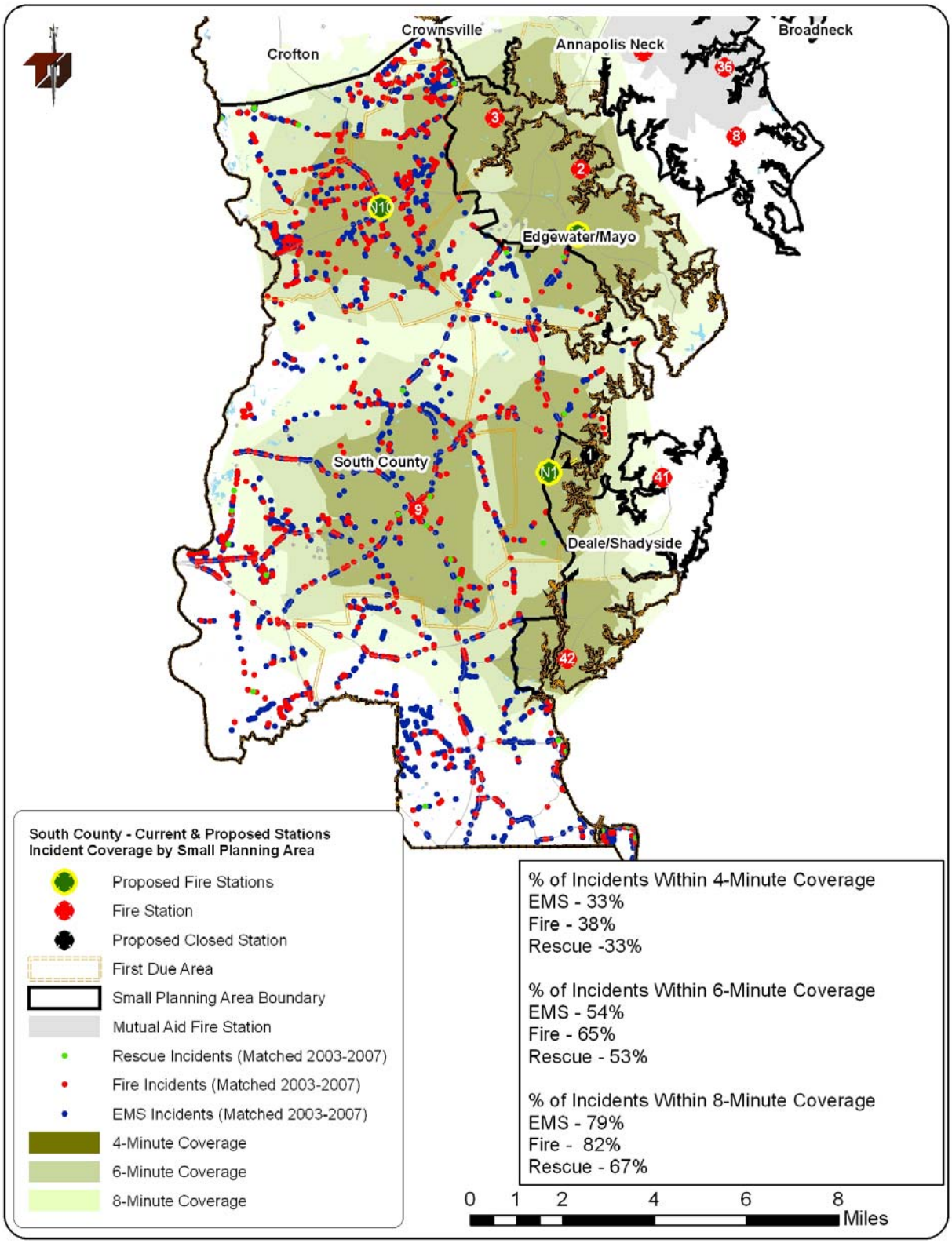


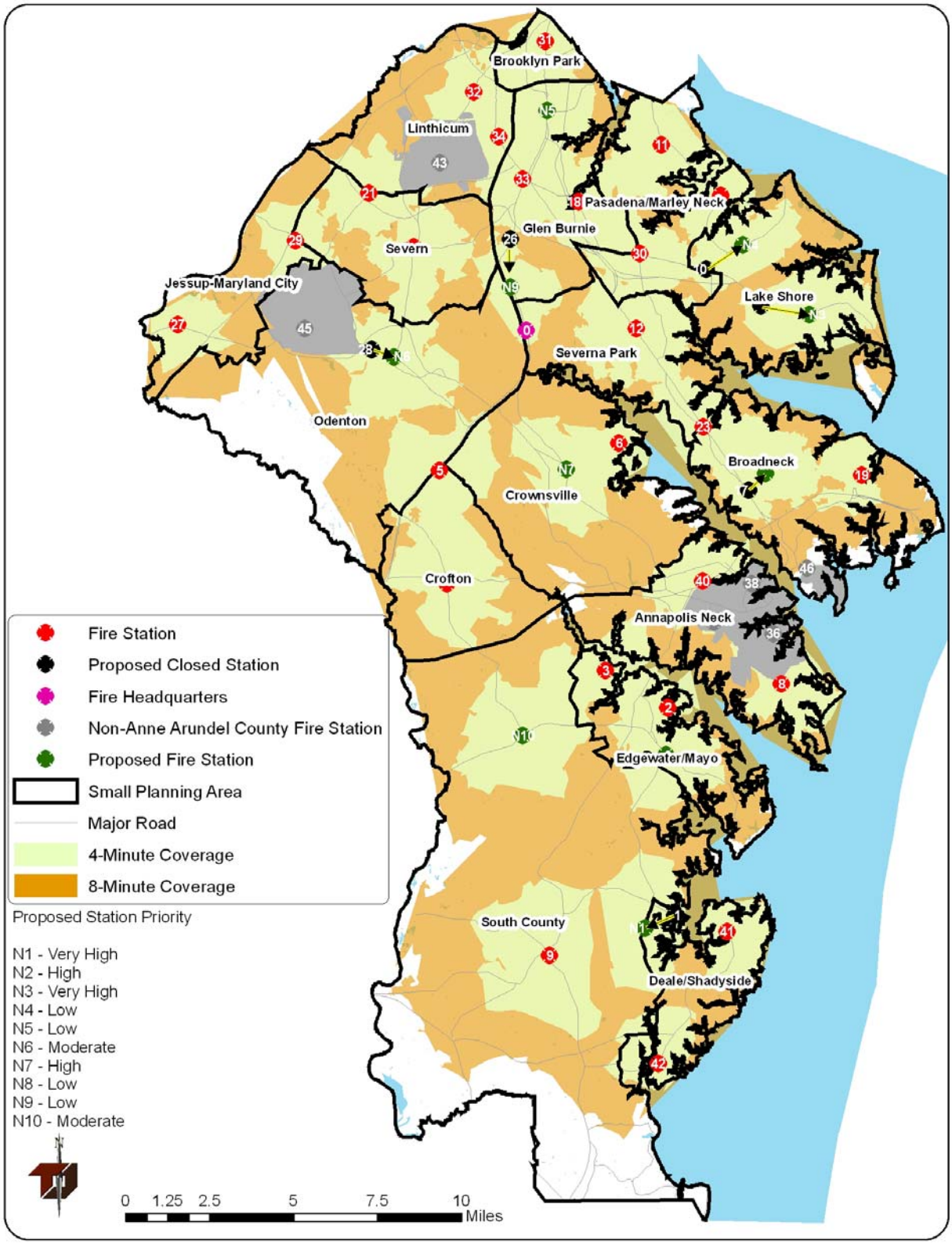
Table 34 shows the proposed changes by planning area with the respective incident coverage in terms of percent of incidents covered. The proposed station location modifications lead to excellent coverage for the county. Map 69 shows theoretical four and eight-minute coverage for the proposed station deployment.

Table 34: Summary Table

Small Planning Area	Proposed Changes	4 Minutes		6 Minutes		8 Minutes	
		Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)	Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)	Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)
Annapolis Neck	Paramedic Engine at new station 8	68	68	96	96	99	99
Broadneck	Relocate station 17	63	72	91	91	98	97
Brooklyn Park		99	100	100	100	100	100
Crofton		86	86	100	100	100	100
Crownsville	New station 6 with existing career staff, volunteers may remain at current station 6	24	49	59	75	93	95
Deale/ Shadyside	Relocate station 1	72	73	93	94	100	100
Edgewater/ Mayo	New station 2 with existing career staff, volunteers may remain at current station 2	73	81	77	92	86	98
Glen Burnie	Relocate station 26 Relocate Truck/Tower from station 33 or 26 to station 21 New station 34 with existing career staff, volunteers may remain at current station 34	80	84	100	100	100	100
Jessup-Maryland City	Update station 29	70	70	94	94	99	99
Lake Shore	Relocate station 20 Relocate station 10	66	71	85	93	95	100

Small Planning Area	Proposed Changes	4 Minutes		6 Minutes		8 Minutes	
		Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)	Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)	Current Total Incident Coverage (%)	Proposed Total Incident Coverage (%)
BWI/ Linthicum		73	73	99	99	100	100
Odenton	Relocate station 28	66	78	94	97	100	99
Pasadena/ Marley Neck		58	86	93	93	100	100
Severn		64	62	100	100	100	100
Severna Park		71	76	91	100	100	100
South County	Build new station	30	34	40	56	70	79

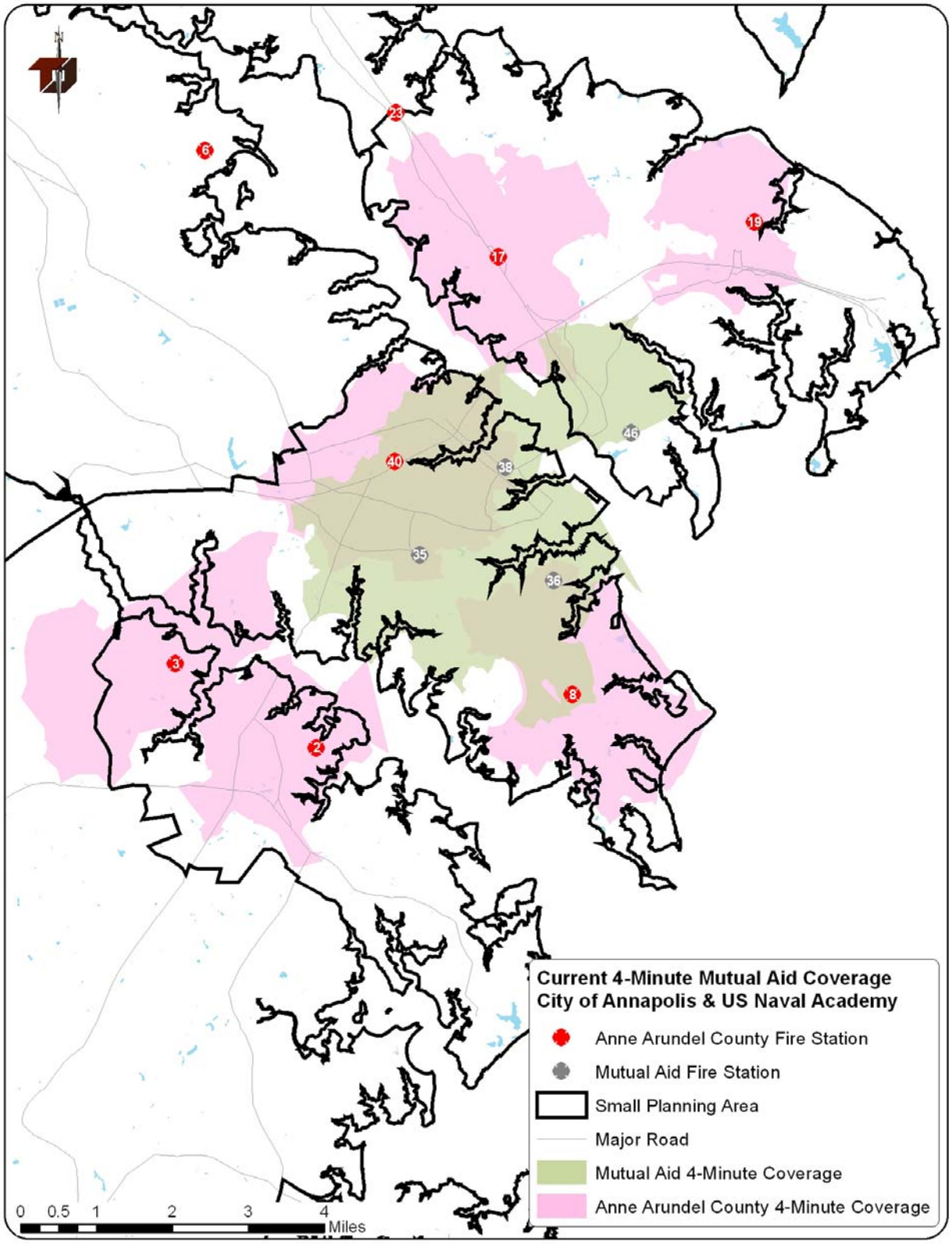
Map 69: Anne Arundel County Proposed 4 and 8-Minute Coverage



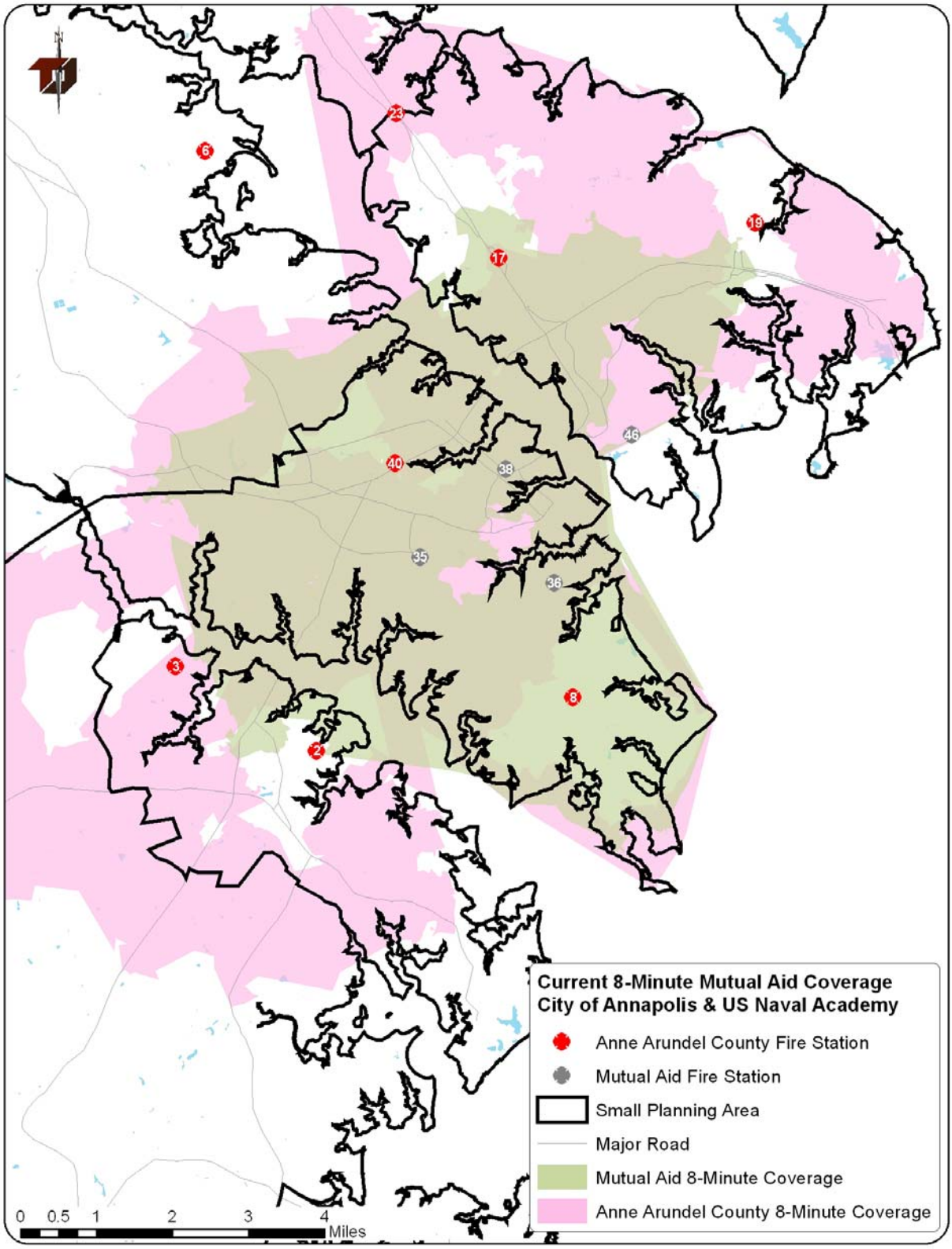
Mutual Aid

Mutual Aid stations were excluded from the calculations in this chapter, because these stations operate as autonomous jurisdictions and there is no guarantee they will be available to respond to an incident. However, the mutual aid station locations were considered in the overall response time analysis. Following are the maps showing the four and eight-minute coverage for mutual aid stations. For the City of Annapolis and the U.S. Naval Academy, overlap areas with Anne Arundel County are represented by the darker areas. For BWI and Ft. Meade, an assumed travel time of one-minute is used for a unit to respond from the fire station to the perimeter of its respective first due area. The remaining three-minute coverage is shown on the maps. Overlaps are shown at both four and eight minutes.

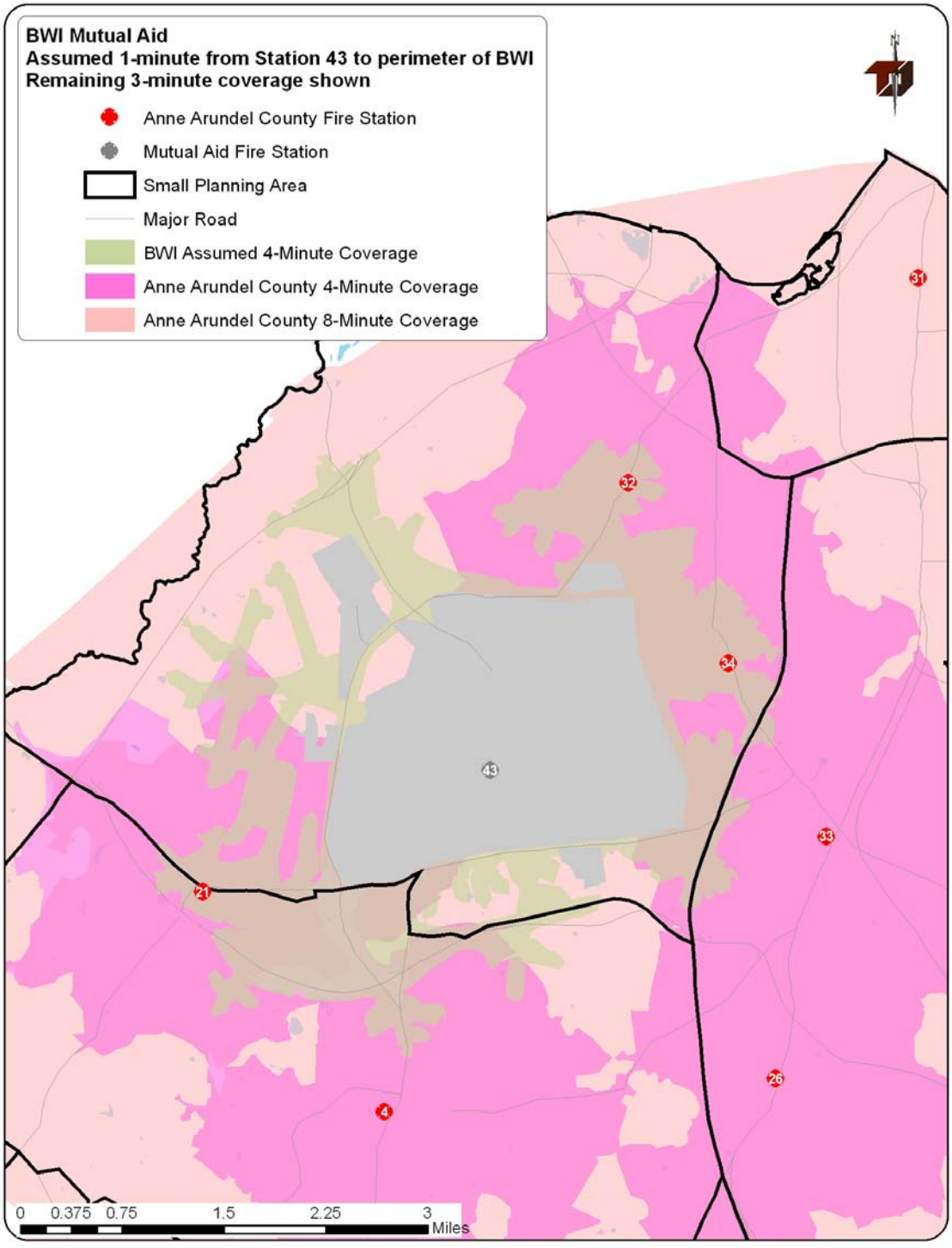
Map 70: Current 4-Minute Mutual Aid Coverage – City of Annapolis & U.S. Naval Academy


Current 4-Minute Mutual Aid Coverage
City of Annapolis & US Naval Academy
Anne Arundel County Fire Station
Mutual Aid Fire Station
Small Planning Area
Major Road
Mutual Aid 4-Minute Coverage
Anne Arundel County 4-Minute Coverage
0 0.5 1 2 3 4
Miles

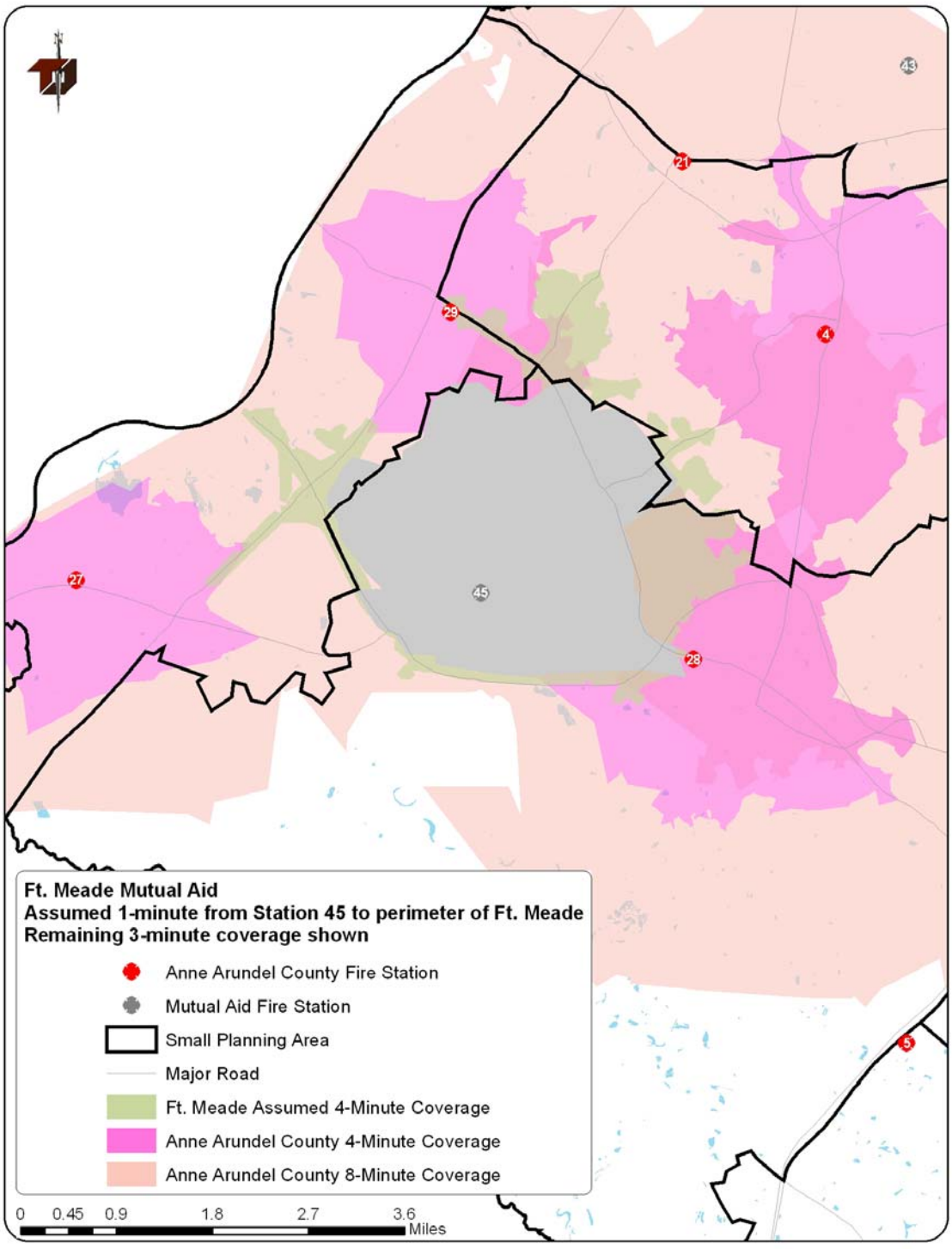
Map 71: Current 8-Minute Mutual Aid Coverage – City of Annapolis & U.S. Naval Academy


Current 8-Minute Mutual Aid Coverage
City of Annapolis & US Naval Academy
Anne Arundel County Fire Station
Mutual Aid Fire Station
Small Planning Area
Major Road
Mutual Aid 8-Minute Coverage
Anne Arundel County 8-Minute Coverage
0 0.5 1 2 3 4
Miles

Map 72: Current Mutual Aid Coverage – BWI



Map 73: Current Mutual Aid Coverage – Ft. Meade


Ft. Meade Mutual Aid
Assumed 1-minute from Station 45 to perimeter of Ft. Meade
Remaining 3-minute coverage shown
Anne Arundel County Fire Station
Mutual Aid Fire Station
Small Planning Area
Major Road
Ft. Meade Assumed 4-Minute Coverage
Anne Arundel County 4-Minute Coverage
Anne Arundel County 8-Minute Coverage
0 0.45 0.9 1.8 2.7 3.6
Miles

IV. FIRE OPERATIONS

In this section we discuss the fire suppression operations of the department. The chapter also includes recommendations to improve staffing levels at various stations and the redeployment of units. The chapter concludes with a comparative analysis of fire departments similar to Anne Arundel and a summary of staffing changes that result from the recommendations in this section. The entire slate of personnel (and station) changes recommended by this study are included in Chapter VII.

Current Situation

The Anne Arundel County Fire Department (AACoFD) is similar to many suburban departments in that it provides both fire and medical services. That it covers such a wide variety of risks makes it unique. The northern portion of the county, which is very urban, requires more resources than does South County, which is very rural. Meeting the demands for services and still providing equity is often a challenge, particularly deploying the right number and type of resources in the right places. To its credit the AACoFD has progressed to a highly-regarded and competent organization since it was first organized in 1965.

The county's Insurance Services Office (ISO) rating is currently a 4/9. Under ISO, areas with no fire protection are rated ten, thus a rating of nine in some areas of the county is not particularly good. In most instances, areas rated as nine are outside a five-minute response time and do not have municipal water for fire protection.

ISO ratings are used by insurance companies to establish the insurance rate for residential property. Based on the local communities' ability to provide fire protection, ISO is focused primarily on fire loss and does not consider medical service, which is the area of highest demand for the county. Stations where staffing levels are low such as Station 1 (Galesville-South County), Station 6, (Herald Harbor-Crownsville), and Station 27 (Maryland City) are problem areas for the county and they result in higher ISO ratings and insurance costs. A cost-benefit analysis of the county's ISO rating is not within the purview of this study, but should be done to help trade off increased costs of fire protection vs. decreased insurance costs.

Although the department has made considerable progress since its inception, staffing levels in most areas of the county have not kept pace with the demand for services, especially EMS. For this reason, response times have been getting longer. At the heart of the problem is the handle-first-emergency (HFE) concept used at many fire stations. In the HFE concept, cross-trained fire suppression and medical crews respond to the first emergency reported with the

appropriate unit and other units at the station are left unstaffed. The HFE approach works well when call volumes are low, which is not the case in the county now.

The medical delivery system uses a 'tiered' response system with three levels of response. Advanced life support (ALS) units, staffed with two paramedics or one paramedic and one EMT-Intermediate, are the top level and are dispatched on the most serious medical calls. Referred to as 'paramedic' units, these units are staffed with two ALS providers. The second tier is medic units, which are staffed by one paramedic and one firefighter/ EMT. The third tier (basic life support) are ambulances staffed with two firefighter/ EMTs or an EMT-B and an EMT-I.

Until recently all of the ALS units deployed by the county were two-person 'paramedic' units. In an attempt to improve service and deploy more ALS units, the county began deploying medic units. However, restrictions were placed by the medical director on the number of medic units deployed, preferring instead the two paramedic system.

The current EMS system is not meeting the needs of the county. In the first place, the two paramedic requirement for most medical units takes too many ALS resources and most calls dispatched as 'paramedic' calls are not found to require that level of care. National studies and one recently conducted by the fire department's own medical staff do not support the requirement that two paramedics be on every cardiac arrest call. The county's decision for two paramedics is based in part on a previous administration's insistence that every medic unit respond with two paramedics.

Key factors influencing the changes recommended in this section include:

- Increased demand over the last five years has resulted in a noticeable increase in response times, county-wide; increased response times are also related to the cross-staffing approach used by the fire department
- The county's primary fire risk will continue to be in residential properties
- The area of highest demand will be EMS
- Mutual aid is working well; the county receives the benefit of better coverage in rural areas where another fire station cannot not be justified by demand
- The major issue in terms of service delivery is inadequate staffing and cross-staffed EMS units
- Most fire units have too few responders onboard to be effective

- Response protocols for on-scene personnel compliments are too high in some cases; these negatively impact response times for other calls, particularly medical calls
- On average, nine fire units are necessary to provide the on-scene personnel complements requirements mandated by the AACoFD
- The three-tiered EMS model is not working and better results can be achieved by incorporating paramedic engines and staffed BLS units
- Hospital turn-around times (average of 44 minutes) are too long and hurting medical response times
- The average response for volunteers is .9 persons per call; not enough to sustain operations at many stations; Stations 7, 12, 13, and 28 have the best volunteer participation with an average of almost 3 volunteers per call
- The trend for EMS calls to increase and fire incidents to decrease will continue for awhile, then level off
- BRAC will have minimal impact on the county's emergency services; increases in demand will primarily be on the EMS side primarily from vehicle accidents and transportation-related incidents
- Duplication of services is somewhat of a problem; for example, the county does not need nine heavy rescue squads

From the perspective of personnel and station deployment, the county is in a good situation for it has time to make the needed changes. However, if it elects not to make adjustments and add resources for EMS, the situation could become critical very quickly.

Overview of the Organization

AACoFD is organized similar to other fire departments. The fire chief is the designated head of the organization and is appointed by and reports to the County Executive. Major bureaus of the department are managed by deputy fire chiefs. Figure 10 and Figure 11 depict the overall fire department organization and the operations bureau.

Figure 10: AACoFD Organization

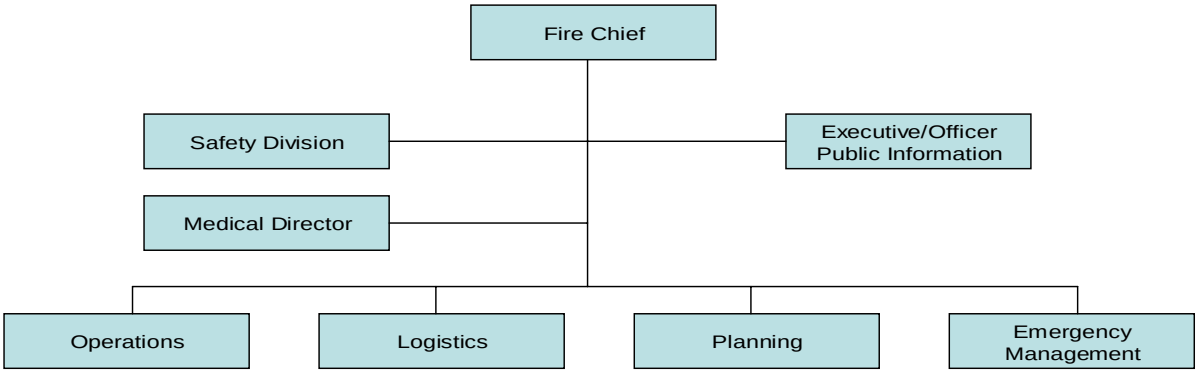
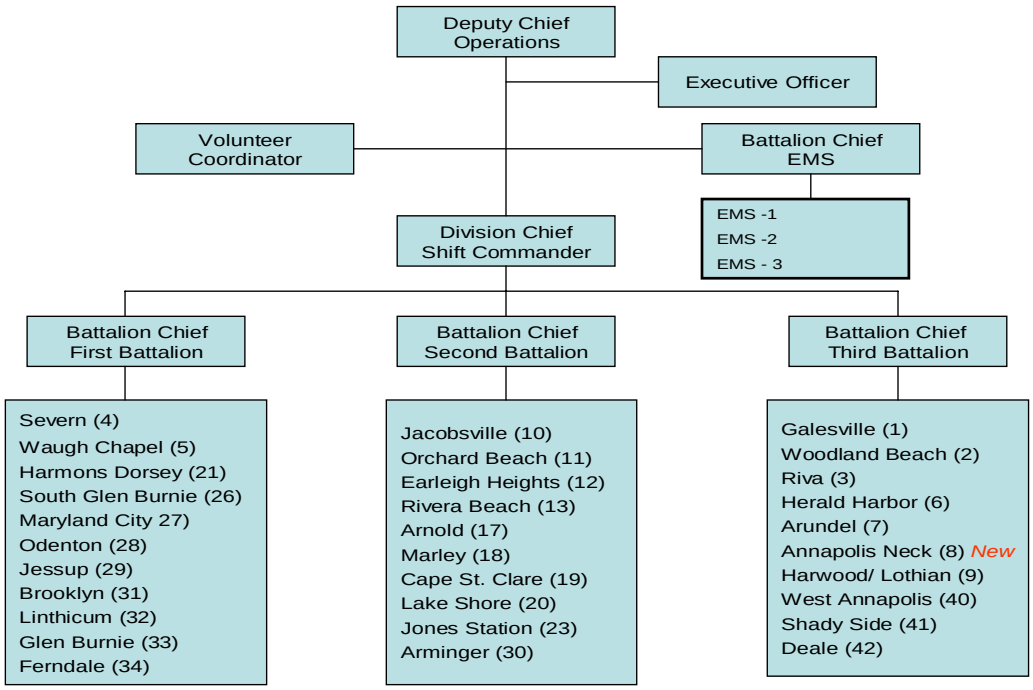


Figure 11: AACoFD Operations Bureau



At the time of this study, the fire department's authorized staff level is 833. Of these, 34 are civilian and 7 are contract employees; the remaining 792 positions are uniformed employees, a majority of whom are assigned to stations.

Following is the department's authorized staffing for operations.

Table 35: Authorized Positions Assigned to Operations, FY08

Rank	Authorized/ FY08
Captain	31
Lieutenant	128
Firefighter V (EMT-P)	161
Firefighter IV (EMT-I)	46
Firefighter III (Driver/ Operator)	202
Firefighter II (EMT)	224
Total	**792**

The above staffing does not include 28 command and supervisory positions of battalion chiefs, shift commander, and EMS shift officers. These positions are considered part of the daily shift compliment. These positions were not considered in the staffing analysis of this study because they are considered part of the fire or medical crews assigned to units, which is the primary focus of this study. Fire and EMS command staff assigned to shifts are discussed elsewhere in this report, however.

Personnel up to and including the rank of captain are represented by IAFF Local 1563 while those at the rank of battalion chief and above are considered 'exempt' employees and not represented by a bargaining group.

The current fire department budget is $95.31M. Of this amount, $69.9M is allocated for fire and EMS operations. Table 36 shows the fire department's budget from 2006–2008.

Table 36: AACoFD Budget, FY06–FY08

Budget Category	FY06/ Actual	FY07/ Actual	FY08/ Approved
Administration	$2.65M	$3.58M	$4.24M
Services Bureau	$17.59M	$21.26M	$21.15
Fire Operations	$45.29M	$46.31M	$51.93
EMS and Special Operations	$19.84M	$18.55M	$17.98M
Total Budget[17]	$85.38M	$89.69M	$95.31M
Personnel Services	$71.12M	$74.98M	79.53M
Percent for Personnel Services	83	84	83

Of the total budget from 2006 through 2008, 83 percent is allocated for personnel services. It is typical for the percentage of personnel in a fire department budget to range from 85 to 95 percent of the budget. Therefore, AACoFD has a little more discretionary money than do other organizations, which is good.

[17] Budget amounts were rounded, therefore budget totals may not add correctly.

Since FY06, the department's budget has increased by almost $10.0M, or 11.7 percent. Most of the increase is a result of the additional personnel needed to reduce the workweek from 48 to 42-hours. Under the current 42-hour schedule, personnel work 24-hours on-duty followed by 72-hours off. The 42-hour workweek is more prevalent in the northeast while 48 or 56 hour workweeks are more typical elsewhere.

Fire and EMS Deployment and Staffing

At the time of this study the fire department operated from 30 strategically located stations. In addition, a new station (8) in the Annapolis Neck area is planned and should be on-line early in 2009. Fire and EMS unit staffing varies from station to station and throughout the county. In the past, decisions about where to locate career personnel were more often than not predicated on the desires of individual volunteer companies.

As it stands now, the AACoFD, although technically a 'combination department', is a career department augmented by volunteers in some areas. This is an important distinction to make since the fire department was a mostly volunteer force augmented by a few career personnel during the first two decades of its existence. Going forward, the county should do everything possible to maintain and enhance its active cadre of volunteers.

Table 37 shows each of the county's 30 stations and the units located at each station. Apparatus identified as "VO" are owned by the volunteer companies and those marked as "CO" are county-owned. The table also shows the minimum on-duty career complement and the level of medical service provided from each station.

Table 37: Apparatus Resources and Minimum Career Staff by Station[18]

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
1 – Galesville Deale/ Shady Side	1 Engine (CO) 1 Tanker (CO) 1 Paramedic (CO)	1 Squad (VO) 1 Brush (VO)	ALS		2 - FF 3 1 - FF/PM T = 3
2 – Woodland Beach Edgewater/ Mayo	1 Paramedic Engine (CO) 1 Engine (VO) 1 Medic (CO)	1 Squad (VO)	ALS	1 Ambulance (CO)	1 - Officer 1 - FF 3/PM 1 - FF 2 1 - FF/PM T = 4 Volunteers staff the reserve BLS unit
3 – Riva Edgewater/ Mayo	2 Engines (VO) 2 Tankers (VO) 1 Paramedic (CO) 1 BC (CO)	1 Brush (CO) 1 Mass Casualty Trailer (CO)	ALS		1 - Officer 2 - FF3 2 - FF2 1 - FF/PM T = 6
4 – Severn Severn	1 Quint (CO) 1 Paramedic (CO) 1 BC (CO)	Mobile Communications Command Unit (CO)	ALS	1 Ambulance (CO) 1 Engine (CO)	1 - Officer 1 - FF3 2 - FF2 1 - PM T=5

[18] To provide services effectively, the fire department continually evaluates and thus changes the deployment of staff to some of its stations. Therefore, the actual rank depicted in column 6, "Minimum Staffing", may be slightly different than shown.
[19] Minimum staffing does not include battalion chiefs or EMS officers.

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
5 – Waugh Chapel Crofton	1 Engine (CO) 1 Paramedic (CO) 1 DC (CO)		ALS	1 Truck/ Tower (CO)	1 - Officer 1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T=5
6 – Herald Harbor Crownsville	1 Pumper/ Tanker (CO) 1 Engine (VO) 1 Medic (CO)	1 Brush (VO) 1 Special Unit (VO)	ALS		1 - FF3 1 - FF/PM T = 2 HFE (handle-first-emergency)
7 – Arundel Crofton	1 Engine (CO) 1 Engine (VO) 1 Ambulance (CO)	1 Squad (VO)	BLS		1 - FF3 1 - FF2 T = 2 HFE (handle-first-emergency)
8 – Annapolis Neck Annapolis Neck	(New)	(New)			(New)
9 – Harwood/ Lothian South County	1 Pumper/ Tanker (CO) 1 Paramedic (CO) 1 EMS (CO)	1 Brush (CO)	ALS	1 Engine (CO) 1 Paramedic (CO)	1 - Officer 1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T = 5

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
10 – Jacobsville Lake Shore	1 Pumper/ Tanker (CO) 1 Paramedic (CO)		ALS	1 Ambulance (CO)	1 - 0fficer 1 - FF3 1 - FF/PM 1 - FF/EMT-I T = 4
11 – Orchard Beach Pasadena/ Marley Neck	1 Engine (VO) 1 Truck/ Tower (VO) 1 Ambulance (CO)	1 Brush (VO) 1 ROC (VO) 1 Special Unit (VO) 1 Squad (VO)	BLS		1 - Officer 1 - FF3 1 - FF2 T = 3 HFE (handle-first-emergency; if medical call only 1 person (officer) staffs the engine
12 – Earleigh Heights Severna Park	2 Engines (VO) 1 Paramedic (CO)	1 Brush (VO) 1 Squad (VO)	ALS		1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T = 4
13 – Rivera Beach Pasadena/ Marley Neck	1 Engine (VO) 1 Pumper/ Tanker (VO) 1 Quint (VO) 1 Ambulance (CO) 1 Paramedic (CO)	1 Brush (VO) 1 Fire Boat (VO) 1 Squad (VO)	ALS and BLS		1 - FF3 2 - FF2 1 - FF/PM T = 4 One FF3 and one FF2 cross-staff the BLS unit and engine

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
17 – Arnold Broadneck	1 Engine (CO) 1 Engine (VO) 1 Paramedic (CO)	1 Brush (VO)	ALS		1 - Officer 1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T = 5
18 – Marley Glen Burnie	1 Engine (CO) 1 Paramedic (CO)	1 Brush (CO)	ALS	1 Engine (CO) 1 Paramedic (CO)	1 - Officer 1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T = 5
19 – Cape St. Clare Broadneck	2 Engines (VO) 1 Ambulance (CO)	1 Brush (VO) 1 Fire Boat (61)	BLS	1 Engine (CO)	1 - Officer 1 - FF3 2 - FF2 T = 4 Staffing of four; two on BLS unit and two on engine.
20 – Lake Shore Lake Shore	1 Engine (VO) 1 Pumper/ Tanker (VO) 1 Ambulance (VO)	1 Brush (VO) 1 Fire Boat (VO)	BLS		1 - Officer 1 - FF3 2 - FF2 T = 4 Staffing of four; two on BLS unit and 2 on engine

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
21 – Harmons Dorsey Severn	1 Engine (CO) 1 Paramedic (CO)		ALS		1 - Officer 1 - FF3 2 - FF2 1 - FF/PM T = 5
23 – Jones Station Broadneck	1 Quint (CO)	1 Squad/ Dive/ Special Ops (CO)	None		2 - Officers 2 - FF3 2 - FF2 T = 6
26 – South Glen Burnie Glen Burnie	1 Engine (CO) 1 Truck/ Tower (CO) 1 Paramedic (CO)		ALS		1 - Officer 2 - FF3 3 - FF2 1 - FF/PM 1 - FF/EMT-I T = 8
27 – Maryland City Jessup-Maryland City	1 Engine (CO) 1 Engine (VO) 1 Paramedic (CO)	1 Brush (CO)	ALS and BLS	1 Ambulance (CO) 1 Engine (CO)	1 - FF3 1 - FF/PM T = 2
28 – Odenton Odenton	2 Engines (VO) 1 Ambulance (CO) 1- Truck/ Tower (VO)		BLS		1 - FF3 2 - FF2 T = 3/1 FF3 is 24/7; Two FF2's are weekdays only
29 – Jessup Jessup-Maryland City	1 Pumper/ Tanker (CO) 1 Medic (CO)	1 Brush (VO)	ALS	1 Engine (CO) 1 Paramedic (CO)	1 - Officer 1 - FF3 2 - FF2 1 - FF/PM T = 5

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
30 – Arminger Pasadena/ Marley Neck	1 Quint (CO) 1 Medic (CO) 1 EMS Officer (CO) 1 BC (CO)	1 Decon (CO)	ALS	1 Engine (CO) 1 Truck/ Tower (CO)	1 - Officer 1 - FF3 2 - FF2 1 - FF/PM T = 5
31 – Brooklyn Brooklyn Park	1 Engine (CO) 1 Truck/Tower (CO) 1 Paramedic (CO)		ALS		1 - Officer 2 - FF3 3 - FF2 1 - FF/PM 1 - FF/EMT-I T = 8
32 – Linthicum BWI/Linthicum	1 Engine (CO) 1 Paramedic (CO)	1 ROC (CO)	ALS	1 Paramedic (CO) 1 Truck/ Tower (CO)	1 - Officer 1 - FF3 1 - FF2 1 - FF/PM 1 - FF/EMT-I T = 5
33 – Glen Burnie Glen Burnie	1 Engine (CO) 1 Engine (VO) 1 Truck/ Tower (CO) 1 EMS Officer (CO) 1 Paramedic (CO) 1 Ambulance (VO)	1 Squad (VO)	ALS and BLS		1 - Officer 2 - FF3 3 - FF2 1 - FF/PM 1 - FF/EMT-I T = 8
34 – Ferndale BWI/ Linthicum	1 Engine (CO) 1 Engine (VO) 1 Ambulance (CO)	1 Brush (CO) 1 Squad (VO)	BLS		1 - FF3 1 - FF2 T = 2 HFE (Handle- first--emergency)

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
35 – Annapolis (MA) Annapolis Neck	1 Tanker (CO)	N/A	N/A		N/A
40 – West Annapolis Annapolis Neck	1 Engine (CO) 1 Engine (VO) 1 Tanker (VO) 1 Truck/ Tower (CO) 1 Medic (CO)	1 Brush (CO)	ALS		1 - Officer 2 - FF3 3 - FF2 1 - FF/PM 1 - FF2/ weekdays T = 7/8
41 – Shady Side20 Deale/ Shady Side	1 Engine (CO) 1 Ambulance (CO)	1 Brush (CO) 1 Fire Boat (CO)	BLS	1 Engine (CO) 1 Ambulance (CO)	1 - Officer 1 - FF3 2 - FF2 T = 4 HFE (Handle-first-emergency); if fire call is first, no one to staff BLS unit. Two personnel must be marine response certified.

[20] Shady Side Station 41 is also referred to as Avalon Shores.

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
42 – Deale Deale/ Shady Side	1 Engine (VO) 1 Pumper/Tanker (VO) 1 Truck/ Tower (VO) 1 Medic (CO)	1 Brush (CO) 1 Fireboat (VO) 1 Boat (VO)	ALS		1 - Officer 1 - FF3 1 - FF2 1 - FF/PM T = 4 HFE (Handle-first-emergency); if fire call is first, no one to staff ALS unit.
Other County Vehicles		1 Air Unit (CO)		2 Engines (Hold-back) (CO)	N/A
Totals	**20 - Engines (VO)** **14 - Engines (CO)** **4 - Trucks/ Towers (CO)** **3 - Trucks/ Towers (VO)** **3 - Quints (CO)** **1 - Quints (VO)** **4 - Pumper/Tankers (CO)** **3 – Pumper/Tankers (VO)** **3 - Tankers (VO)** **2 - Tankers (CO)** **17 - Paramedics (CO)**	**9 - Squads (VO)** **1 – Squad/ Haz/tech (CO)** **9 – Brush (VO)** **9 - Brush (CO)** **1 – Special Unit (VO)** **1 – Mass-Casualty Unit (CO)** **1 Mobile Command Unit** **1 – ROC (CO)** **1 – ROC (VO)** **1 – Air Unit (CO)** **2 – Fireboats (VO)** **2 – Fireboats (CO)** **1 - Boat (VO)**	**22 ALS** **10 BLS**	**9 – Engines (CO)** **3 – Truck/ Towers** **4 - Paramedics** **5 – Ambulances (CO)**	**Career Staffing =** **134 plus 4 weekdays)21 = 138**

[21] Not including EMS shift officers (3), battalion chiefs (3), or shift commander (1).

Station/ Planning Area	First-Line Units	Special Services	ALS/ BLS	Reserve Units	Minimum Staffing[19]
	5 - Medics (CO) 8 - Ambulances (CO) 2 - Ambulances (VO) 3 – Battalion Chief 3 - EMS Supervisors 1 – Division Chief	1 – Decon (CO) 1 – Dive Unit (CO) 1- Collapse Rescue Unit (CO)			

Of the total first-line fire and EMS fleet, 58 vehicles are county-owned and 31 are owned by the independent volunteer companies. The total number of vehicles in the fire department's fleet is typical for a county the size of Anne Arundel, in particular a combination department, which generally has more vehicles than all-career organizations. That the volunteers purchase some of the vehicles is to the county's financial advantage.

Fire and EMS Unit Staffing

The fire department uses a cross-staffing approach at many of its stations where the same individuals who staff fire units also staff the medical unit. In the cross-staffing concept, referred to locally as 'handle-first-emergency' (HFE), the available crew handles the first reported call regardless of its severity. As previously noted, this works well when call volumes are low. However, call levels in the county are such now that cross-staffing is not working so well. The response time analysis combined with the analysis of demand showed that the lack of enough independently staffed medical units is causing most of the problem with long response times.

The minimum daily staffing required for each shift is 134 plus 3 weekday positions. This does not include four chief officers and three EMS supervisor positions because these were not considered in the overall deployment analysis. To meet this level, 176 personnel are typically assigned to each of the four shifts. Policy allows 35 personnel to be scheduled off on annual leave at a given time, which is 19.8 percent of the personnel assigned to a shift (38/176).

Using data from annual leave (anticipated) and sick/accident leave (unanticipated), the fire department has calculated its staffing factor at 5.12 for non-officer positions and 5.14 for officers, the difference being that officers are more senior and accrue more leave. Staffing factors also consider vacancies. The staffing factor means that just over five persons must be assigned to cover each 24-hour position. A recently implemented 42-hour workweek significantly increased the number of personnel required to staff each shift.

Standards such as the National Fire Protection Association's 1710 have been established to help determine appropriate crew sizes.[22] However, there is disagreement on how the standards should be met and whether they are appropriate at all since communities vary in their population density, risk factors, as well as their tolerance to accept more or less risk. Communities also vary on their ability to pay for more or less service. Because firefighter safety is important, many communities have generally supported such standards but few have actually adopted the standard as law. In our opinion, each community is different and staffing requirements should be based on

[22] Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments.

the situation, not on a 'one-size fits all' approach. Therefore, we considered Anne Arundel County's unique situation regarding staffing.

In urban communities, four or even five-person crews are common while three-person crews are more common in smaller, less urban communities. The NFPA 1710 standard places emphasis on the total personnel available at the incident rather than how they arrive, which we believe is appropriate. If too few responders are on each unit however, more units must be dispatched to assemble an adequate force, on-scene. Dispatching more units to achieve the necessary on-scene force, although efficient in terms of lower operating costs, is not effective because response times to other, subsequent calls become longer. It also means having more emergency vehicles running through the county with lights and sirens, and more chance of vehicle accidents. The need for more multiunit dispatches is increasing as the volume of calls increases, a fact supported by the response time analysis presented in an earlier chapter.

The county has too many fire units responding with two and sometimes even one person, which is inadequate. However, the county's fire risk and incident history do not require four-person staffing on every fire suppression unit. Nevertheless, we do recommend four-person crews for ladders, towers, and quints in Anne Arundel County, for reasons we discuss later. In addition to the cross-staffed HFE concept, understaffing of fire units is exacerbating the response time problem because more units must respond to get an adequate, on-scene force within the desired time limit.

Engine and Truck/ Tower Staffing – Typical staffing on the county's fire units is two or three personnel, although a response by one person, a driver, is not uncommon, especially in rural areas with volunteers. Given the county's mostly suburban flavor with areas that are very much urban in North County, three-person engine crews are reasonable, but with four-person crews in those remote areas where response times are considerable longer for the next due units, and the first one on the scene has to begin operating on its own. The rationale for the larger crews in rural areas is supported by the Occupational Safety and Health Administration's (OSHA) two-in/ two out standard. In urban areas of the county a second crew is likely to be on-scene before the first crew is ready to begin interior operations, which is not the case in rural parts of the county.

Truck/ tower staffing in the county is two or three personnel but does not include an officer. The effectiveness of two or three-person truck staffing is questionable. Deployed to support engine operations at structure fires and other calls where forcible entry, rescue, and specialized operations are required, a two-person crew (without a supervisor) is unable to

provide the level of support these operations require. Even three-person crews are inadequate, especially without a supervisor.

Although structure fires are not a common occurrence in the county, they do occur. The county is not overly populated with truck/ tower companies and those that are provided should be adequately staffed, preferably by four personnel. Including an officer in the four-person crew would also improve their effectiveness rather they relying on an engine officer to supervise two separate and typically autonomous, operations. Likewise, quint units which double as engines but are also used as truck companies should be staffed with four personnel as well.

Recommendation 14: Establish the three-person crew as the minimum for engines and four-person crews in the more rural areas where response times (for second and third-due units) are longer.

Recommendation 15: Increase the minimum crew size on ladders/ towers and quints to four personnel, including an officer.

Volunteer Squad Companies – At the time of this study nine squad companies were deployed throughout the county by the independent volunteer companies. By any measure, the county does not require this many specialized units. That so many squads are deployed in one jurisdiction is not unusual, particularly in volunteer circles because past practice was for each volunteer organization to be independent and mostly self-reliant. Given the demand for these services and the size of the county, it could easily operate with two squad companies, one north and one south of Route 50. The question for the county now is how best to use these resources which are already in-place.

On idea is for the volunteers themselves to organize a system where two of the nine squads are staffed (24/7) by four volunteers (including an officer) at all times. Under the plan, volunteers who meet the minimum requirements would sign up in advance using an electronic roster system such that two of the volunteer squads would be staffed at all times.

As an example, Squads 2 and 11, which are located at opposite ends of the county, might be staffed at the same time. A crew-size of four is suggested but a three-person team would be acceptable, though not as effective for the same reasons that four-person crews are recommended for ladders/ towers.

It is believed that county volunteers would seriously consider this as a viable concept because they are almost guaranteed to go on calls and they can use their many skills and training when they do. It also rotates the possibility of county-wide responses for these specialized units from station to station. Finally, using the squads in this manner will improve the number of on-scene personnel without dispatching as many fire units as the department does now.

Implementing the volunteer squad rotation concept would have a positive impact on response times, particularly for medical calls.

Recommendation 16: Maintain the current number of squads but implement a rotation plan such that volunteers staff two squads 24/7. Allow the volunteers to develop the rotation and staffing plan.

On-Scene Personnel Requirements – AACoFD protocols require 18 personnel to be on-scene at a structure fire in areas where fire hydrants are located and 20 personnel where there are no hydrants. The protocol has been in place for some time with the rationale that operational tasks in rural areas without public fire hydrants are more labor intensive, which is true. However, just as a 'one-size fits-all' approach to unit staffing is not the best; these requirements are too rigid and should be modified.

Guidelines established by NFPA suggest varying the number of personnel on-scene based on the hazard level of the structure. Although these guidelines are not tested by research the guidelines were developed considering the tasks most often performed at structure fires, thus are reasonable for planning purposes.

Under the NFPA guidelines, low-hazard risks are those for residential structures while moderate and high-hazard risks are larger commercial and industrial occupancies with special hazards or large places of public assembly. For the county, the large square footage of residential properties in some areas of the county would probably classify them as moderate (or even high-hazard) risks and therefore require more personnel on-scene. However, this is not the norm.

Table 38 compares the fire department's on-scene staffing requirements with those recommended by NFPA.

Table 38: Response Level Comparisons, AACoFD vs. NFPA

Type of Occupancy	AACoFD Response Complement		NFPA Guidelines
High-Hazard	Hydrant Area	Non-Hydrant Area	4 Engines 2 Ladder Trucks 24 Firefighters 2 Chief Officers
Total Responders	***18***	***20***	***26***
Medium-Hazard	Hydrant Area	Non-Hydrant Area	3 Engines 1 Ladder Truck 16 Firefighters 1 Chief Officer
Total Responders	***18***	***20***	***17***
Low-Hazard	Hydrant Area	Non-Hydrant Area	2 Engines 1 Ladder Truck 12 Firefighters 1 Chief Officer
Total Responders	***18***	***20***	***13***

In a majority of cases the fire department must dispatch eight or nine units to achieve the recommended minimum personnel. Remembering that in many instances these units are cross-staffed (HFE) stations, it is easy to understand why large portions of the county become depleted of resources with the occurrence of only one structure fire call.

This situation is particularly true in South County with stations 41 (Shady-Side) and 42 (Deale) as well as other rural areas such as Crownsville, which has only one station (Herald Harbor). When medical calls immediately precede or follow a structure fire call, the situation becomes even more critical and response times become longer. Under these circumstances large portions of the county then require units to respond from long distances and response times become long, which is the major problem for the county.

The situation can be remedied in two ways: 1) by improving unit-level staffing and eliminating cross-staffed EMS units; 2) lowering the number of personnel required on-scene, particularly for smaller residential structures. Improving unit-level staffing will also improve on-scene staffing compliments at high-hazard occupancies such as high-rise structures without sending to many units. In conjunction with a four-person volunteer squad just discussed, the following on-scene complements could be achieved if the recommended minimums for unit staffing were implemented.

Table 39: Proposed AACoFD On-Scene Complements vs. NFPA

Type of Occupancy	Response Complement	NFPA Guidelines
High-Hazard	Hydrant and Non-Hydrant Areas	4 Engines
	4 Engines (three or four personnel)	2 Ladder Trucks
	2 Trucks/ Towers (four personnel)	
	1 Squad (four personnel)	
	24 Firefighters (+/-)	24 Firefighters
	2 Chief Officers	2 Chief Officers
Total Responders	***26***	***26***
Medium-Hazard	Hydrant and Non-Hydrant Areas	3 Engines
	3 Engines (three or four personnel)	1 Ladder Truck
	1 Truck/ Tower (four personnel)	
	1 Squad (four personnel)	
	17 Firefighters (+/-)	16 Firefighters
	1 Chief Officer	1 Chief Officer
Total Responders	***18***	***17***
Low-Hazard	Hydrant and Non-Hydrant Areas	2 Engines
	2 Engines (three or four personnel)	1 Ladder Truck
	1 Truck/ Tower	
	1 Squad	12 Firefighters
	14 Firefighters (+/-)	1 Chief Officer
	1 Chief Officer	
Total Responders	***15***	***13***

The suggested resource levels do not include additional units for rapid intervention teams or other specialized situations. When these are needed to meet operational safety standards they will be in addition to the proposed schedule. In the proposed plan where medic units are independently staffed from fire units, EMS response times are less affected by fire calls.

Recommendation 17: In conjunction with improved units staffing, revise the on-scene complements such that smaller structures require fewer personnel. At the same time, increase the response complements for high-hazard occupancies.[23]

Event Nature Codes – AACoFD has an extensive list of nature of event codes used to classify calls and determine the appropriate response level. Event codes are computer designations used by dispatchers to classify calls. They determine the type and number of units dispatched to various calls. Dispatch supervisors have the authority to change the event type, or to upgrade/downgrade the event based on available information. A review of the event codes found them to be fine and typical of other departments.

[23] The fire department agrees with this recommendation but it has concerns that it would be difficult to implement.

Although the event codes appear good, it seems the department has adopted an unwritten policy of dispatching a first responder unit (typically an engine) on every medical call, regardless of how minor it may be. Numerous individuals expressed concern that very minor medical calls were eliciting the response of a fire unit. The policy, if true, is not a good one and the fire department should revisit the protocol and its affect on response times. For very minor medical calls where response time is not an issue, it is probably better not to dispatch the closest engine—or at least dispatch them non-emergency and maintain their status as being available in case a true emergency arises.

Recommendation 18: Review the first-responder policy for medical calls and consider other options than dispatching an engine on every call.

Mutual Aid – Anne Arundel County is fortunate to have an excellent system of mutual aid. In most instances mutual aid is on-request but some areas do use automatic mutual aid, where the nearest unit is dispatched as first due even if from another fire service system. Fire department staff was positive about mutual aid and most believed the system works well. There were no concerns that the county is unfairly subsidizing service to other local governments and the county 'gets as good as it gives' in most situations. Mutual aid medical service to Baltimore City is the one area where more service is delivered than received. However, Baltimore City provides the county with acceptable fire suppression capabilities (including an all-career staff), thus the trade-off is probably neutral.

Geographically the county is very large and there are many areas, particularly in South County, where demand is low. In these areas the county could not justify additional stations and the current approach to use mutual aid is good. Calvert County and Prince George's County augment the county's service to these areas and the arrangement is acceptable.

Annapolis City and the U.S. Naval Academy, both all-career departments, provide mutual aid to the Annapolis Neck region and have been relied on for many years. The much needed addition of a new station (8) to Annapolis Neck will lessen the need for mutual aid but not eliminate it entirely because this area has very high demand.

Mutual aid is also excellent in the northern portion of the county where support can be requested from a variety of departments, including Baltimore City, Baltimore County, Howard County, Fort Meade, and Baltimore-Washington International Airport. Going forward, the fire department should maintain the good working relationship with all of these mutual aid departments.

One area of improvement is to expand automatic aid agreements among the various departments to cover areas of the county that are closer to other jurisdictions. Another area to

consider is to standardize the dispatching protocols such that automatic aid is available in more areas with dispatching protocols standardized in the metro area. As they currently exist, each department with which Anne Arundel cooperates with mutual aide has their own, unique protocols.

A standard system has been in place for many years in the Chicago-land region where numerous cities and counties have access to automatic assistance and 'move-ups' when large fires and other events occur. Called the Mutual Aid Box Alarm System (MABAS), the arrangement is considered a best practice. It is similar to the statewide system used in California for large wildland fires. To implement such a system would require significant effort on the part of local officials; however the end result would be worth it.

Recommendation 19: Evaluate whether to initiate efforts to implement a system similar to the MABAS in the Baltimore metropolitan region to improve mutual aid.

Management and Supervision

The fire department has well-trained officers at both the command level (battalion and division chief) and company officer level (captain and lieutenant). However, many of its new officers do not have much fire suppression experience because they spent so much of their operational time assigned to EMS units. Reportedly, about 20 percent of its officers were used mostly in medical response positions before being promoted to fire officer.

As a fully integrated fire and EMS organization, AACoFD can improve the competency of its future officers by placing paramedics on fire units where they will get more firefighting experience. This approach will also improve response times to medical calls with paramedics arriving on-scene faster at the most serious medical emergencies. More information will follow on this concept in the next section.

Shift Commanders and Battalion Chiefs – A recent budget situation resulted in a decision to reduce the number of battalions from four to three with an on-duty division chief (shift commander) replacing one of the battalion chiefs to supervise the shift. In the past, division chiefs were on-duty during weekdays at headquarters with senior command officers rotating on-call responsibilities after regular working hours. The realignment is a point of contention with some who believe the span-of-control is too broad under the new alignment. Concerns were also expressed that it takes too long for a command officer to arrive on-scene with only three battalions and that operational safety and effectiveness have been compromised.

The new arrangement was considered important because many of the newly promoted battalion chiefs and company officers had so little experience. There were also concerns about the consistency of personnel administration and management practices with the recently

implemented four-platoon schedule. Under the new alignment, the department is administratively organized under three battalion chiefs, who are responsible for the personnel and training on their respective shift. A division chief, located at Station 5 (Waugh Chapel), coordinates the shifts daily activities, supervises the battalion chiefs on his platoon, but does not directly manage station personnel.

Although the change has resulted in more administrative work for three battalion chiefs, the shift commander does monitor calls and responds when he is closer. In this regard, response times are not likely to be any higher than under the previous arrangement. It is also arguable that safety and operational effectiveness are being compromised since a senior commander probably arrives faster now than when they responded after regular work hours from home.

It is our opinion that shift commanders assigned to 24-hour shifts is a better alignment for the department's organization. However, to determine whether its benefit is real, the fire department should analyze the response times of chief officers before and after the change. It should also compare other outcome statistics such as fire loss, injuries/ fatalities, and how many incidents required additional equipment or alarms to mitigate.

From a resource needs perspective, improving EMS and fire unit staffing is a much higher need for the county than more chief officers. Adding a fourth battalion requires four more battalion chiefs on each shift at a projected cost in excess of $500K. Adding four battalion chiefs into the budget should be lower on the county's list of service improvement needs.

Recommendation 20: Maintain the present alignment of three battalion and one division chief for the present. Begin to collect data to analyze its impact, and whether more are really needed, which we doubt.

Company Officers – Presently only one career officer is assigned to each station even when two suppression units are staffed. The exception is Station 23, the special operations station where a squad and quint are located. The typical arrangement is to have a captain assigned to one shift with lieutenants assigned to the remaining three shifts.

In the case where engines and trucks/towers are collocated, it is typical that an officer responds on the engine and a senior firefighter on the ladder, typically as a two or three-person team. However, senior firefighters are not considered in-charge of the unit or personnel. Operating trucks/ towers in this manner is not an effective practice because the tactical considerations of engines and ladders are quite different. Crew accountability is also a concern.

Changes recommended by this study include a slight increase in the number of officers to staff each ladder with a supervisor.

Recommendation 21: Increase the staffing level at stations with two fire suppression units such that each unit always responds with an officer.

Volunteer Services

Anne Arundel County is fortunate to have a committed group of volunteers. The evolution of the volunteer service in the county is similar to that experienced nationally and the number of active volunteers continues to decline. Going forward, anything the county can do to stem the exodus of volunteers is a good, financial bargain.

For this study we considered the volunteer participation level at each station and the staffing recommendations are based on the most recent data for the activity level of the volunteers. Going forward the county should revisit volunteer participation levels and make the appropriate changes in career staffing—up or down.

There are many independently-owned volunteer stations in the county where volunteer participation is too low to be effective. In many of these same stations, there are not enough career personnel on duty to provide an adequate response force. This is a common situation nationally as departments transition from all-volunteer departments to mostly volunteer and then to career or mostly-career departments.

The combination system in Anne Arundel is unique because volunteers are fully integrated into the fire department's rank structure even though volunteer officers are either elected or appointed by the independent volunteer fire companies. Within the rank structure, volunteer chiefs are higher than career captains but lower than a battalion chief. Volunteer officers are required to meet the same professional qualification standards as those for career officer. This is a best practice that many combination departments have been unable to achieve, which is a credit to the volunteers and department management.

At the time of this study, 524 volunteer personnel were listed by the fire department as qualified responders. This means they had the necessary training and medical certifications to respond on calls and actively participate at emergencies. However, most of the informed persons we spoke with, including volunteers, believe the number of active responders is less than 50 percent of the volunteers listed on the department's roster. The data reviewed by us for each volunteer station supports this view.

As a proportion of the total station membership, Station 42 has the most active membership; Stations 3 and 33 have the least. The data suggests that the number of active volunteers is much lower than even 50 percent of the total roster and probably closer to 20 or 25 percent. From experience we know that most volunteer fire organizations have far more members on the books than are really active, the percentages here indicate that only a small

portion of the 524 certified personnel are actually responding to calls. Going forward more volunteers need to participate, or the county will have to hire more personnel.

Table 40 shows the number of certified volunteers for each station considered a volunteer corporation, and the average number of responders per call. In the case of Stations 1, 3, 31, and 32, these are classified as volunteer because they still retain their corporate status. However they have no volunteers certified to respond on calls. Station 28 (Odenton) did not report the number of volunteers per call; therefore, we did not include them in the number of responders or percentage of responders per call average.

Table 40: Certified Volunteers and Volunteers Responding per Call/ By Station

Volunteer Stations	Certified Volunteers	Responders per Fire Call	Percentage of Certified Volunteers Typically Responding to Calls
1	0	0.0	0
2	38	1.8	5
3	0	0.0	0
6	19	0.5	3
7	40	2.5	6
11	39	1.0	3
12	34	2.2	6
13	49	2.8	6
17	20	0.8	4
19	19	0.3	1
20	23	0.6	3
27	29	1.6	5
28	87	Not Reported	Not reported
29	3	0.18	6
31	0	0.0	0
32	0	0.0	0
33	33	0.12	<1
34	42	1.6	4
40	27	0.3	1
42	22	1.5	7
Average/ Station	**33**	**1.2**	**3.75**

As can be seen in Table 40, the average number of certified responders per volunteer station is 33. Of these, less than two volunteers typically respond to calls in each station based on the data we reviewed. Combined, volunteer stations turn out less than four percent of their available members for calls. Stations with the highest volunteer response to fire calls are Stations 7, 12, and 13. Data from Station 28 (Odenton), which has the highest number of volunteers (87)

and is very active, was not reported. Stations where fewer than one or no volunteers responding to calls included Stations 2, 6, 11, 17, 19, 20, 29, 33, and 40. Again, we did not include Stations 1, 3, 31, and 32, because there are no volunteers even though the corporation still exists.

'Attended Status' and Scheduling Volunteers – AACoFD is unique because volunteers must notify fire dispatch of their availability (attended status) via mobile-data-terminal (computer) or station telephone. In most volunteer systems, there is a lapse in the time between alerting volunteers of the call and knowing whether they will respond—and with how many personnel. If a unit is not 'attended', the CAD system automatically recommends the next available (staffed) unit. The typical approach in other volunteer departments is to consider all units available and wait to see if volunteers respond.

The "attended status" policy is a good practice, albeit it has probably hastened the exodus of volunteers in Anne Arundel. Volunteer fire personnel, unlike those who volunteer in other community settings like hospitals, have resisted policies that require themselves to be scheduled. For its part, the fire department does not track the "attended status" rate of volunteer stations, although it should. Developing a plan to scheduling county volunteers and improve "attended status" rates would be a good move for the county.

The Odenton Volunteer Fire Company (28) is the only volunteer company to presently schedule its personnel. Scheduling volunteers has been used successfully in other metropolitan areas such as Montgomery and Prince George's County, Maryland. If volunteers in Anne Arundel were to adopt such a concept county-wide, the county should consider incentives for personnel who agree to volunteer for a minimum number of hours each week or month. Qualified volunteers who agree to be scheduled would also save the county on overtime, which has been an issue for some time.

If, for example, the county and volunteers could agree on a policy where volunteers are scheduled, the county would benefit from a higher participation level of its certified volunteers. During major events such as storms, volunteers already standby when requested by the fire chief so the precedence is already there. If only 25 percent of the certified county volunteers agreed to a scheduling system and they agreed to be at the station and available to respond for at least 6 hours each week (24 hours per month), the county would accrue 3,000 hours of volunteer time each month. This would improve the "attended status" for volunteer companies and it would increase the availability rate for career units, particularly on the medical side.

Recommendation 22: Work with the Volunteer Association to adopt a county-wide policy for scheduling volunteers. As part of the package, consider improving the incentive programs for volunteers who schedule their participation. Volunteers might also be scheduled to periodically cover career vacancies instead of paying overtime.

Reciprocity Agreements – A unique feature is the 'reciprocity agreements' between the volunteer companies and the county. Under these agreements, the county and local volunteer departments articulate in writing the operational and financial terms of their relationship. Ultimately, 'reciprocity agreements' establish the conditions for career staffing, apparatus purchases, who pays for utilities, etc. Volunteers do not receive county funding unless an agreement is in place, which is an appropriate strategy.

Interjurisdictional Comparisons

To put a department's performance in perspective, it can be helpful to compare the department with other organizations that share similar characteristics. In doing so, department leaders can identify benchmarks that can be used to assess their own performance. When these comparisons are drastically different, further evaluation is required.

Jurisdictional comparisons can be difficult to interpret as there are many variables. No two jurisdictions are exactly alike in terms of geographic size and features, population dynamics, or governmental organization and services provided. However, many jurisdictions do share some similar qualities that are useful for comparison. While these comparisons are not direct indicators of departmental performance, they do provide a valuable function in assessing a department in relation to the performance of its peers. This direct comparison identifies organizational strengths and suggests areas for improvement.

The jurisdictions chosen for comparison possess similar characteristics to Anne Arundel County. Data for the analysis was obtained from websites and direct contact with the departments, submitted surveys to the various departments, and used U.S. Census (2006) data. We compared several different attributes on a per capita basis including: stations and equipment, cost, staffing, and fire loss. Averages shown in the comparison tables were calculated without Anne Arundel included.

With 30 fire stations, each station in Anne Arundel covers approximately 13.9 square miles. Geography is a major determinant of the number of stations; the more irregular the shape of the county, the more stations needed. Despite a population density less than the average of the other jurisdictions, Anne Arundel County has more stations covering smaller areas, primarily because of its irregular shape.

As shown in Table 41, comparable jurisdictions average 15.1 square miles per station. One factor to consider in this assessment is the population density of the jurisdiction.

Table 41: Comparison of Population Served per Station

Jurisdiction	Population	Area Served (Square Miles)	Number of Stations	Density (Pop/ Square Miles)	Population/ Station	Square Miles/ Station
Fairfax County, VA	1,010,443	395	37	2,558	27,309	10.7
Prince George's County, MD	841,315	485	46	1,735	18,289	10.5
Mecklenburg County, NC	827,445	526	38	1,573	21,775	13.8
Baltimore County, MD	787,384	599	58	1,314	13,576	10.3
Prince William County, VA	357,503	338	19	1,058	18,816	17.8
Chesterfield County, VA	296,718	426	21	697	14,129	20.3
Henrico County, VA	284,399	238	20	1,195	14,220	11.9
Howard County, MD	272,452	252	11	1,081	24,768	22.9
Loudoun County, VA	268,817	520	17	517	15,813	30.6
Average	**549,608**	**420**	**28**	**1,303**	**18,867**	**15.1**
Median	**357,503**	**426**	**21**	**1,195**	**18,553**	**12.9**
Anne Arundel County, MD	509,300	416	30	1,224	16,977	13.9

We also requested information from each jurisdiction about the number of apparatus staffed each day. Table 42 shows the number of engines, trucks, heavy rescues or squads, quints, and EMS transport units.

Table 42: Comparison of Fire and Rescue Apparatus

Jurisdiction	Population	Engines	Trucks	Heavy Rescues/ Squads	Quints	EMS Transport Units-ALS	EMS Transport Units-BLS
Fairfax County, VA	1,010,443	37	14	8	0	25	17
Prince George's County, MD	841,315	44	24	12	1	11	40
Mecklenburg County, NC	827,445	39	0	2	14	0	0
Baltimore County, MD	787,384	88	16	9	0	46	2
Prince William County, VA	357,503	18	5	4	0	10	18
Chesterfield County, VA	296,718	21	5	2	0	11	
Henrico County, VA	284,399	20	5	3	0	13	0
Howard County, MD	272,452	13	5	3	0	11	1
Loudoun County, VA	268,817	37	4	4	3	18	18

Jurisdiction	Population	Engines	Trucks	Heavy Rescues/ Squads	Quints	EMS Transport Units-ALS	EMS Transport Units-BLS
Arlington County, VA	199,776	9	3	2	0	7	0
Average	**514,625**	33	**8**	**5**	**2**	**15**	**11**
Median	**327,111**	29	**5**	**4**	**0**	**11**	**2**
Anne Arundel County, MD	509,300	27	7	8	4	22	8

Table 43 takes the comparison another step by considering equipment per capita and the ratios among different types of apparatus. Anne Arundel is at the averages for engine and truck companies. The jurisdiction has well above-average numbers for heavy rescues, and an above average total EMS transport units. For both engines and EMS transport units, the values per 10,000 residents are very near average. These tables indicate that Anne Arundel does not need to consider too many new units, but rather a redistribution of existing apparatus.

Table 43: Apparatus Ratios

Jurisdiction	E:T Ratio	Engines/ 10,000 Pop	EMS Units/ 10,000 Pop
Fairfax County, VA	2.6	0.37	0.42
Prince George's County, MD	1.8	0.52	0.61
Mecklenburg County, NC	2.8	0.47	N/A
Baltimore County, MD	5.5	1.12	0.61
Prince William County, VA	3.6	0.50	0.78
Chesterfield County, VA	4.2	0.71	0.37
Henrico County, VA	4.0	0.70	0.46
Howard County, MD	2.6	0.48	0.44
Loudoun County, VA	9.3	1.38	1.34
Arlington County, VA	3.0	0.45	0.35
Average	**3.9**	**0.67**	**0.60**
Median	**3.3**	**0.51**	**0.46**
Anne Arundel County, MD	3.9	0.53	0.61

Cost per capita for fire protection gives a rough indication of efficiency; it does not consider quality of service. Nevertheless, while many factors play into this ratio, it can be useful to compare peer jurisdictions. Table 44 shows comparative costs per capita and indicates that Anne Arundel County, with an operating cost per capita of $187, is well above the average of $155 for this metric. The reader should keep in mind that cost per capita can be affected by a variety of reasons. For example, some jurisdictions include pension expenses in the fire

department's general fund account while others may not. Pensions are included in Anne Arundel's cost, which could be one reason for the higher rate.

Table 44: Cost Per Capita

Jurisdiction	Population	Operating Budget	Cost Per Capita	Rank Population/ Cost per Capita
Fairfax County, VA	1,010,443	$133,188,812	$132	1/8
Prince George's County, MD	841,315	$124,800,000	$148	2/6
Mecklenburg County, NC	827,445	$85,387,498	$103	3/10
Baltimore County, MD	787,384	$80,000,000	$102	4/11
Prince William County, VA	357,503	$42,395,121	$119	6/9
Chesterfield County, VA	296,718	$42,000,000	$142	7/7
Henrico County, VA	284,399	$45,999,640	$162	8/4
Howard County, MD	272,452	$75,977,120	$279	9/1
Loudoun County, VA	268,817	$40,256,000	$150	10/5
Arlington County, VA	199,776	$42,763,517	$214	11/2
Average	**514,625**	**$71,276,771**	**$155**	**NA**
Median	**327,111**	**$60,988,380**	**$145**	**NA**
Anne Arundel County, MD	509,300	$95,305,400	$187	5/3

Other factors such as whether 9-1-1 communications are budgeted to the fire department or to a separate agency can also affect cost comparisons. On the other side, departments with higher call volumes and unit workloads would not have much of an impact on operating costs and thus the overall comparisons.

Demand for fire department services is effectively assessed in terms of calls per 10,000 residents. Table 45 shows that Anne Arundel responded to 1,436 calls per 10,000 residents in 2007, which is well above the average of 1,152. Anne Arundel is nearly 57 percent above average demand per capita for fire calls and 49 percent above average for total EMS calls. Note that Mecklenburg County, North Carolina data is not included in Table 45. Their coding of calls resulted such high numbers of "other" calls that including these data points here skewed the results.

Table 45: Calls for Service per 10,000 Residents

Jurisdiction	Total Calls/ 10,000 Pop	Fire Calls/ 10,000 Pop	EMS Calls/ 10,000 Pop	Other Calls/ 10,000 Pop
Fairfax County, VA	911	217	634	60
Prince George's County, MD	1,509	86	1,141	282
Baltimore County, MD	1,446	42	1,021	382
Prince William County, VA	1,081	105	688	287
Chesterfield County, VA	1,058	215	792	52
Henrico County, VA	1,335	42	564	388
Howard County, MD	797	51	575	172
Loudoun County, VA	952	253	603	96
Arlington County, VA	1,282	401	794	88
Average	**1,152**	**157**	**757**	**201**
Median	**1,081**	**105**	**688**	**172**
Anne Arundel County, MD	1,436	246	1,127	64

The “calls for service data” suggests the need for a “Make the Right Call” program for the county, to get citizens not to abuse the emergency services, especially for EMS. It also suggests the need for stronger prevention programs; if demand can be reduced by 20 percent or more, which is found in good public education programs, then less needs to be spent on responses. Prevention is highly cost-effective and the direction in which the fire service in many Western nations are trending. Above average call volumes may also account for some of the higher-than-average per capita costs identified in Table 44.

Overtime costs are often a significant factor in operating a fire department. Table 46 identifies overtime spending as a percentage of operating budgets. At first glance it appears that Anne Arundel is above the average by 16 percent. Removing the large value seen in Fairfax County, however, brings the average down to 3.7 percent and finds Anne Arundel to be 54 percent above average. Another factor to consider is that some jurisdictions consider overtime a “personnel cost” and do not separate all overtime spending. Additionally, the some jurisdictions report what was actually spent on overtime, while others report what was budgeted, which may be above or below the expense actually incurred.

Table 46: Overtime Spending Comparison

Jurisdiction	Operating Budget	2007 OT Spending	Percentage of 2007 Operating Budget on OT
Fairfax County, VA	$133,188,812	$18,680,000	14.0%
Prince George's County, MD	$124,800,000	$6,830,973	5.5%
Mecklenburg County, NC	$85,387,498	$781,700	0.9%
Baltimore County, MD	$80,000,000[24]	$791,259	1.0%
Chesterfield County, VA	$42,000,000	$2,378,175	5.7%
Henrico County, VA	$45,999,640	$1,022,762	2.2%
Howard County, MD	$75,977,120	$3,116,574	4.1%
Loudoun County, VA	$40,256,000	$2,453,240	6.1%
Arlington County, VA	$42,763,517	$1,900,000	4.4%
Average	**$74,485,843**	**$4,217,187**	**4.9%**
Median	**$75,977,120**	**$2,378,175**	**4.0%**
Anne Arundel County, MD	$95,305,400	$5,421,263	5.7%

There are several viewpoints from which staffing should be assessed. Total staffing includes both operational personnel and the support personnel who keep departments running as smoothly as possible, while uniformed staffing is those people whose primary job is staffing fire and EMS apparatus. Total staffing, uniformed staffing, the ratio of uniformed to total staffing, and minimum on-duty staffing per 10,000 residents is depicted in Table 47.

[24] During the review process, a question was raised whether Baltimore County includes overtime in the fire department's annual budget. We contacted Baltimore County officials who confirmed that overtime is included in the annual budget as reported for this study.

Table 47: Staffing Comparisons

Jurisdiction	Total Staffing	Uniformed FF (Career)	Uniformed FF/10,000 Pop	Minimum On-Duty Staffing	Minimum On-Duty Staffing/ 10,000 Pop	% of Total Staffing in Uniform
Fairfax County, VA	1,484	1,395	13.8	328	3.2	94%
Prince George's County, MD	855	768	9.1	277	3.3	90%
Mecklenburg County, NC	1,083	965	11.7	239	2.9	89%
Baltimore County, MD	1,041	998	12.7	190	2.4	96%
Prince William County, VA	452	422	11.8	Not Reported	Not Reported	93%
Chesterfield County, VA	461	414	14.0	97	3.3	90%
Henrico County, VA	534	510	17.9	117	4.1	96%
Howard County, MD	405	382	14.0	72	2.6	94%
Loudoun County, VA	444	393	14.6	112	4.2	89%
Arlington County, VA	314	300	15.0	73	3.7	96%
Average	**707**	**655**	**13.5**	**167**	**3.3**	**93%**
Median	**498**	**466**	**14.0**	**117**	**3.0**	**94%**
Anne Arundel County, MD	860	743	14.6	141	2.8	86%

Table 47 shows that the Anne Arundel County, with 14.6 personnel per 10,000 residents, is above the average value of 13.5. Minimum on-duty staffing, however, shows that Anne Arundel has significantly fewer firefighters on duty per 10,000 residents than their peers. This should be expected, as the work schedule in Anne Arundel County is based on a 42-hour work week, while the average of their peers is 50 hours per week. Accordingly, with a similar department size per capita, there are fewer employees on duty at any given hour.

Fire Loss

One of the primary missions of fire departments is to prevent and minimize property loss. Data was collected to identify the dollar amounts of fire damage reported annually by each jurisdiction. These values are displayed in Table 48 in a per capita format. In each of the past four years, Anne Arundel has been well above the average dollar loss per capita.

Table 48: Fire Loss

Jurisdiction	2007 Fire Loss Per Capita	2006 Fire Loss Per Capita	2005 Fire Loss Per Capita	2004 Fire Loss Per Capita
Fairfax County, VA	$35.78	$41.03	$36.48	$26.75
Mecklenburg County, NC	$25.91	$23.85	$20.15	$22.35
Baltimore County, MD	$14.20	$10.51	$21.03	$37.90
Chesterfield County, VA	$31.91	$48.17	$22.39	$17.37
Henrico County, VA	$53.25	$53.57	$34.43	$27.15
Howard County, MD	$36.87	$42.76	$53.04	$42.03
Loudoun County, VA	$35.34	$51.72	Not Reported	Not Reported
Arlington County, VA	$21.27	$47.40	$12.31	$11.01
Average	**$31.82**	**$39.88**	**$24.98**	**$23.07**
Median	**$33.63**	**$47.40**	**$22.39**	**$26.75**
Anne Arundel County, MD	$85.68[25]	$37.10	$35.27	$30.40

Staffing Changes

To implement the fire unit staffing recommendations in this section will require adjustments to staffing levels at a number of career stations. As was mentioned earlier, the issue with long response times in the county is the cross-staffing (HFE) approach used and the increase in call volumes. On-scene personnel requirements mandated by the fire department are also adding to the problem.

Recommendation 23: To establish a three-person crew as the minimum for engines and four-person crews in the more rural areas.

Required staffing changes/priority:

- Add an officer at Station 12
- Add an officer to Stations 7 and 13
- Increase engine staffing at Stations 1, 6, 9, 27, and 41 to four

Recommendation 24: To increase the minimum crew size on ladders/ towers and quints to four personnel, including an officer.

[25] Analysis of the 2007 data appears to show that the dollar loss for several incidents in Glen Burnie were incorrectly entered into the fire reporting system, thus the findings for 2007 may be inaccurate.

Required staffing changes/priority:

- Increase staffing to Quints 4, 30, Trucks 21, (relocated from S-33), 26, 31, and 40 to four[26]
- Increase staffing at Station 5 from three to four (a quint will replace the engine at Station 5)
- Increase staffing on the special operations unit at Station 23 from three to four

In the case of officers, we address the need for one officer on each unit in the overall staffing plan provided in Chapter VII. A priority for each change is also provided. EMS operations and staffing are addressed in the next chapter.

[26] At the time this study was conducted, Station 28 (Odenton) did not have a truck/tower and the analysis showed that moving Truck 33 to Station 21 was a good move. If Station 28 continues to operate a truck/ tower, the relocation of the unit from Station 33 to Station 21 should be reevaluated.

V. EMERGENCY MEDICAL SERVICES

Emergency Medical Services (EMS) in Anne Arundel County comprises approximately 70 percent of the services provided to its citizens. When including vehicle rescue, the number jumps to approximately 80 percent, which is comparable with most departments of similar size and service areas.

This chapter provides a brief overview of EMS with emphasis on non-operational areas that affect service delivery and cost. Response, station location, and deployment matters are discussed in other chapters.

History of EMS in Anne Arundel County

Anne Arundel County has a rich history in providing quality EMS to its citizens. Early entry into providing EMS and the dedication of industry leaders allowed the county to pioneer several EMS delivery models, including "chase cars," and early adoption of the Department of Transportation Emergency Medical Technician-Paramedic (EMT-P) program. As the nature of the county population increased, volunteer participation decreased, and training costs increased, the county faced the need to modify delivery profiles and training to meet the new challenges. After years of using *chase vehicles* to provide paramedic care, the department decided to place paramedics on traditional ambulance vehicles.

EMS Dispatch

Assessing an EMS system starts with EMS dispatch because a weak link at dispatch translates into a weak EMS system. The 911 center is the primary service access point (PSAP) for the county. The police department is responsible for the PSAP. They transfer fire and EMS calls to the primary dispatch access point (PDAP); where fire and EMS dispatch decisions are made based on a medical priority dispatch system (MPDS). The MPDS was designed by the Priority Dispatch Group (also known as Clawson Model) that classifies calls based on information provided to the dispatcher and the MPDS protocols.

The EMS and Communications divisions are attempting to validate the MPDS by analyzing dispatch data.

EMS Levels of Care

The department uses the following terms to differentiate levels of care:

- ***Paramedic*** – An ambulance staffed by two EMT-Ps (17) or 1 EMT-P and 1 EMT-I
- ***Medic*** – An ambulance staffed by one EMT-P and one EMT-B (5)
- ***Ambulance*** – An ambulance staffed by two EMT-Bs or 1 EMT-B and 1 EMT-I (Volunteer units are staffed exclusively by EMT-Bs) (10)
- ***Medic Engine*** – A non-transport fire engine with one EMT-P and advanced life support equipment (2)

EMT-Paramedic (EMT-P) – The EMS system currently requires a minimum of 34 ALS providers to operate. Of these ALS providers, 24 must be EMT-Ps and an additional 10 can be EMT-Ps or EMT-Is. A combination of greater demand for EMS and fewer available EMT-Ps has challenged the department's ability to provide the appropriate level of care to its citizens. The first issue concerns the need for two EMT-Ps or two ALS providers on all paramedic units.

There continues to be great debate in the medical community whether two paramedics provide better care than one paramedic and one EMT-B. While debate goes on, there currently is little scientific evidence recommending one staffing plan over the other. There is evidence that having too many EMT-Ps may lead to skill decay and poorer patient outcomes if each paramedic does not get enough calls that requires advanced skill use.[27, 28] A small percentage of EMS calls dealing with very critical patients could benefit from two EMT-Ps. The use of paramedic engine companies and strategically placed supervisory units would allow for two paramedics when needed, but also keep more advanced life support services available and ready to respond to other calls when one paramedic can care for the patient.

Recommendation 25: Change the standard crew staffing for a Paramedic unit to at least one EMT-P and one EMT-B.

The "medic" designation is used to indicate when an ambulance is staffed with one paramedic. Changing the Paramedic staffing level makes the Medic unit designation superfluous. It simplifies the levels of service nomenclature and reduces the complexity of dispatch and staffing.

[27] Ludwig, G. (2005). How many paramedics does it take. *EMS Responder*, [Online Version], November 1, 2005, http://www.emsresponder.com/print/Firehouse-Magazine--EMS-Features.
[28] Davis, R. (2005). Paramedics not always the saviors of cardiac arrest patients. USA Today, [Online Version, March 1, 2005. www.usatoday.com/news/health/2005-03-01-ems-cover_x.htm

Recommendation 26: Delete the Medic designation from the delivery profile.

CRT-Intermediate (CRT-I) – In deleting the medic designation, a decision needs to be made concerning the CRT-I or Intermediate designation. The department used the intermediate level provider as a stop gap to mitigate a paramedic shortage. CRT-Is could do many of the EMT-P skills, but had more limited assessment skills. Jurisdictions often train many intermediate providers to quickly be able to provide a minimal ALS level. Some EMS systems have success with this level, but in Anne Arundel County, it appears to offer no benefits. Reducing the number of EMT-Ps needed and adding more basic life support ambulances should reduce the demand for advanced providers.

Recommendation 27: Phase out the CRT-I program.[29] Personnel should be given a date to upgrade to EMT-P or revert to EMT-B. Eliminating the CRT-I level may also be cost effective. CRT-Is who do not upgrade to EMT-P within a reasonable time should be reclassified from FF IV to FF II. There should be no further promotions to FF IV.

Paramedic Engine – A Paramedic Engine (or any staffed and equipped non-transport unit) offers the county several benefits. It allows greater depth of advanced life support coverage in local areas. For example, if the paramedic unit is unavailable, then advanced life support is still available in the area. Further, it allows for rotation of assignment between fire and EMS duties. A dual role/cross trained provider would be able to perform and remain proficient at both sets of duties. When promotional opportunities become available, incumbents are better prepared for either fire or EMS supervisory duties.

Recommendation 28: Increase the use of paramedic engines. Replace the term Medic Engine with Paramedic Engine.

Recommendation 29: After implementing the above recommendations, implement the designations Paramedic, Ambulance, and Paramedic Engine. EMS units should be designated as follows:

- ***Paramedic*** – An ambulance staffed with at least one EMT-P and one EMT-B.
- ***Ambulance*** – An ambulance staffed with at least two EMT-Bs. These can be staffed full-time or during the weekdays between 7:00 AM and 3:00 PM. This designation will also be used by volunteer ambulances.
- ***Medic Engine*** – A non-transport, ALS equipped, suppression unit staffed by at least one EMT-P.

[29] The fire department has begun to implement this recommendation.

EMS Operations

"EMS operations" is the delivery of out-of-hospital care and transportation to the citizens and visitors in Anne Arundel County. Unless specifically mentioned below, the City of Annapolis, the Naval Academy, Fort Meade, and BWI Airport are excluded. The department maintains working mutual aid agreements with these communities.

The current EMS delivery model includes the use of advanced life support (ALS) transport units (Paramedic or Medic), ALS Engines (Medic), EMT-B transport units and first responder fire companies staffed with EMT-B personnel. All advanced life support care is provided by career personnel with career and volunteer personnel providing BLS services. Recommendations below will use the new designations identified above.

Analysis By Planning Area – EMS Strengths, Weaknesses, Opportunities, and Threat (SWOT) Analysis, commonly called a SWOT analysis, was undertaken for each small planning areas. We also considered the multi-year demand forecast and the response time profiles discussed in earlier chapters. Units are identified as advanced life support (ALS) regardless of provider level and basic life support (BLS) for EMT-B service.

The number of EMS calls is based on each unit assigned to a planning area. These results may be different then the actual calls in the area.

Annapolis Neck – Additions to residential and business communities will likely lead to an increase in call volume. The plan for additional EMS coverage at Station 8 is appropriate. Engine 40 should be upgraded to a paramedic engine. Table 49 contains a SWOT analysis for the planning area.

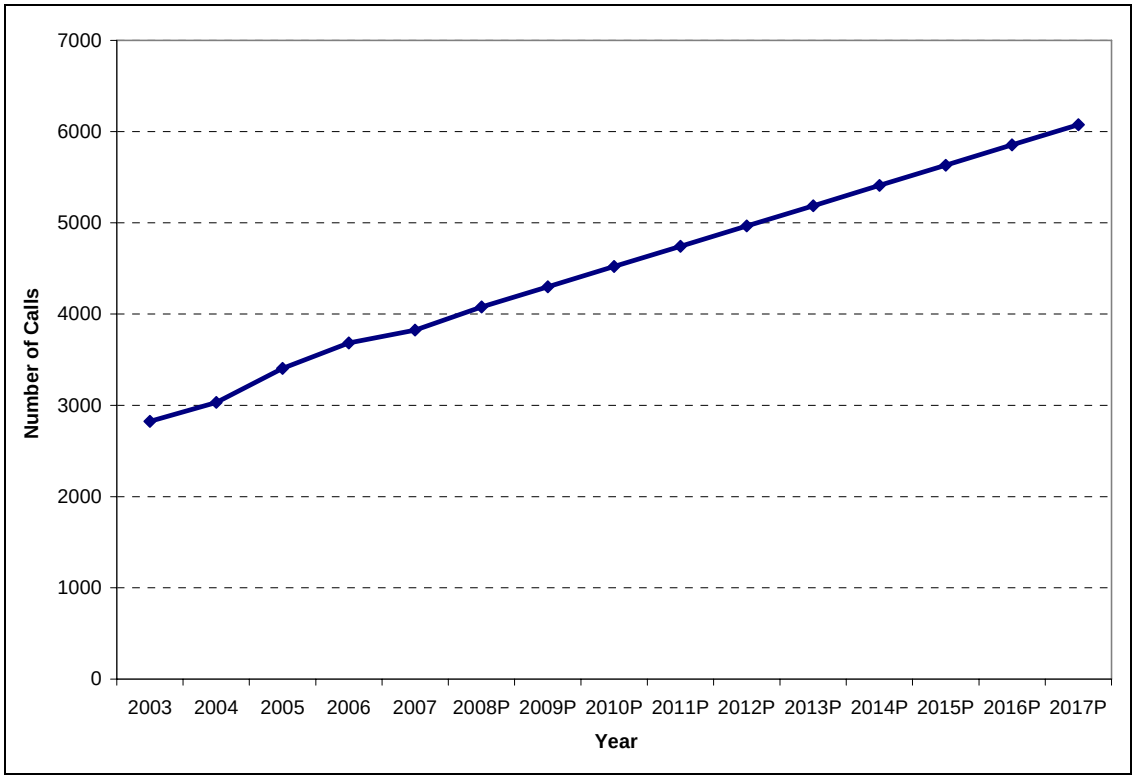
Table 49: Annapolis Neck SWOT

Strengths	Weaknesses	Opportunities	Threats
– Station 40 has significant career staffing during weekdays. – Station 8 is under construction and will be well positioned – Annapolis City can provide mutual aid ALS	90 percentile EMS response times are > 11 minutes. Night and weekend staffing may be insufficient.	Expansion of services is already planned for	Annapolis and the Naval Academy are at higher risk for terrorism Continually increasing demand will require additional EMS services

We predict that the EMS call volume will increase by about 8 percent annually. The total call volume is expected to increase from 3825 in 2007 to 4522 in 2010. The Annapolis City Fire

Department is available for mutual aid, but should not be depended on as their call volume and risk potential is considerable. Forecast 1 shows the predicted increase in responses until 2017.

Forecast 1: Projected EMS Demand for Annapolis Neck



The average response time for Annapolis Neck is 6 min. and 10 sec., which is acceptable. The 90th percentile is 11 min. and 15 sec., which is too long. Extended response times are likely caused by second and third due units being called into the area when the first due unit is busy. Table 50 shows the 2007 response data.

Table 50: Annapolis Neck Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
40	ALS	3825	06:10	11:15
8	In Development			

Medic 40's response load is very high, clearly justifying the addition of Paramedic 8. The longer 90% response times makes a case for Paramedic Engine 40. Depending on how Paramedic 8 will affect the area, another ambulance may be warranted at Station 40. A final decision should be deferred until after Paramedic 8's service is evaluated.

Recommendation 30: Place a Paramedic in Station 8, and upgrade Engine 40 to a Paramedic Engine. An additional BLS unit may be needed at Station 40; a decision should be deferred until Station 8's service is evaluated.

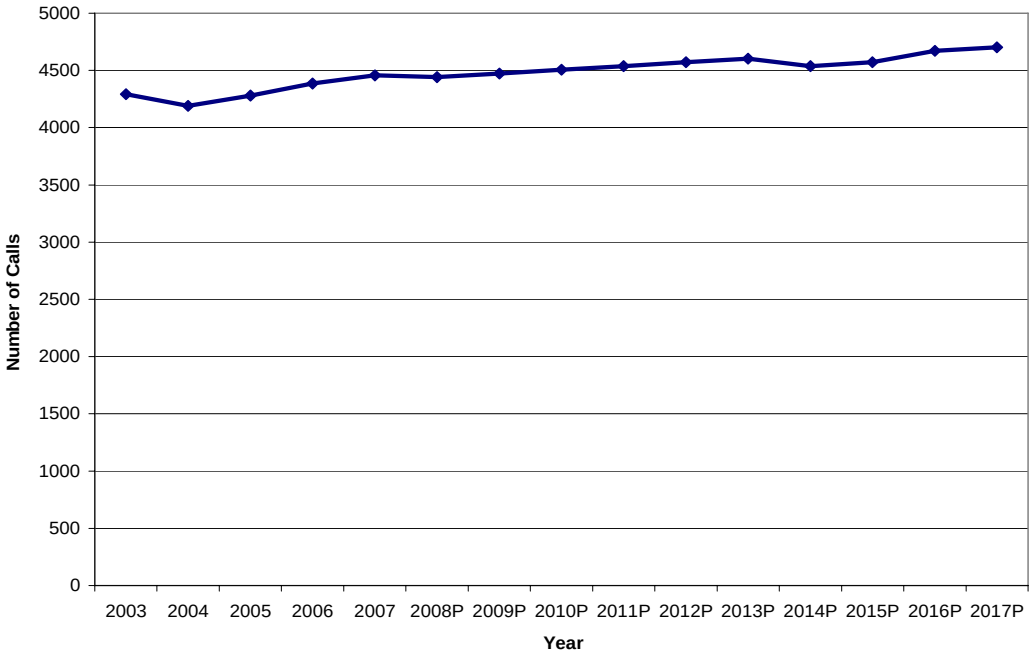
Broadneck – There are some delays in ALS coverage in the northern and northwest area that could be assisted by an ALS unit being placed at Station 23. There are other, even more compelling reasons to place an ALS unit at Station 23, specifically, the need for hazmat EMS specialists and the ability to rotate a paramedic between an ALS transport unit and the Hazmat unit. The scope of hazmat mitigation and response continues to expand. The inclusion of terrorism and CBRNE activities includes greater involvement in patient surge management, mass care, and the use of disease prophylaxis medications and antidotes requires further attention. Paramedics who have additional training in these special emergencies are needed to care for citizens and hazmat team members. Table 51 contains a SWOT analysis for the area.

Table 51: Broadneck SWOT

Strengths	Weaknesses	Opportunities	Threats
Station 17 provides timely EMS coverage to most of the district Good support for Annapolis Neck	Eastern area lacks sufficient ALS coverage Longer response times to the southeastern area, especially along the shoreline	Unit upgrade could easily cover ALS in eastern areas An EMS unit at Station 23 would improve coverage in the northwest area and into Severna Park Paramedics with advanced EMS/hazmat training will strengthen hazmat response.	No EMS unit at station 23 weakens coverage to the northern areas.

The call volume in the Broadneck area is expected to remain stable with an increase of less than 1 percent annually. Forecast 2 indicates the predicted call volume area.

Forecast 2: Projected EMS Demand for Broadneck



The response times for the planning area are acceptable at the mean and 90th percentile levels (Table 52).

Table 52: Broadneck Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
17	ALS	4456	06:17	10:14
19	BLS			
23	None			

Recommendation 31: Add a paramedic to Station 23 primarily to provide ALS Hazmat specialists and improve ALS response times to the north and northwest parts of the planning area. Upgrade Quint 23 to Paramedic Quint 23.

Brooklyn Park – Call volumes in this area are expected to sharply increase at about 10 percent annually. While response times are acceptable, there is a considerable risk of simultaneous calls occurring in the area. The upgrade of Engine 31 to a Paramedic Engine would be a reasonable short-term approach. Table 53 contains a SWOT analysis for the planning area.

Table 53: Brooklyn Park SWOT

Strengths	Weaknesses	Opportunities	Threats
Covers a large area within 4/8 minutes Access to several hospitals and specialty centers	Small coverage gap in the southeast area High volume area bordering a high demand urban area	ALS engine companies could assure coverage during peak periods	There is a high probability of simultaneous emergencies, especially during peak-demand EMS demand will likely increase by almost 40 percent in the next decade

By 2009, the area call volume should reach 5000, signifying the need for a BLS ambulance at Station 31. By 2014, the call volume should be nearing 6500, and the County should consider placing an additional ALS ambulance in service. Forecast 3 shows the predicted call volume changes for the area.

Forecast 3: Projected EMS Demand for Brooklyn Park

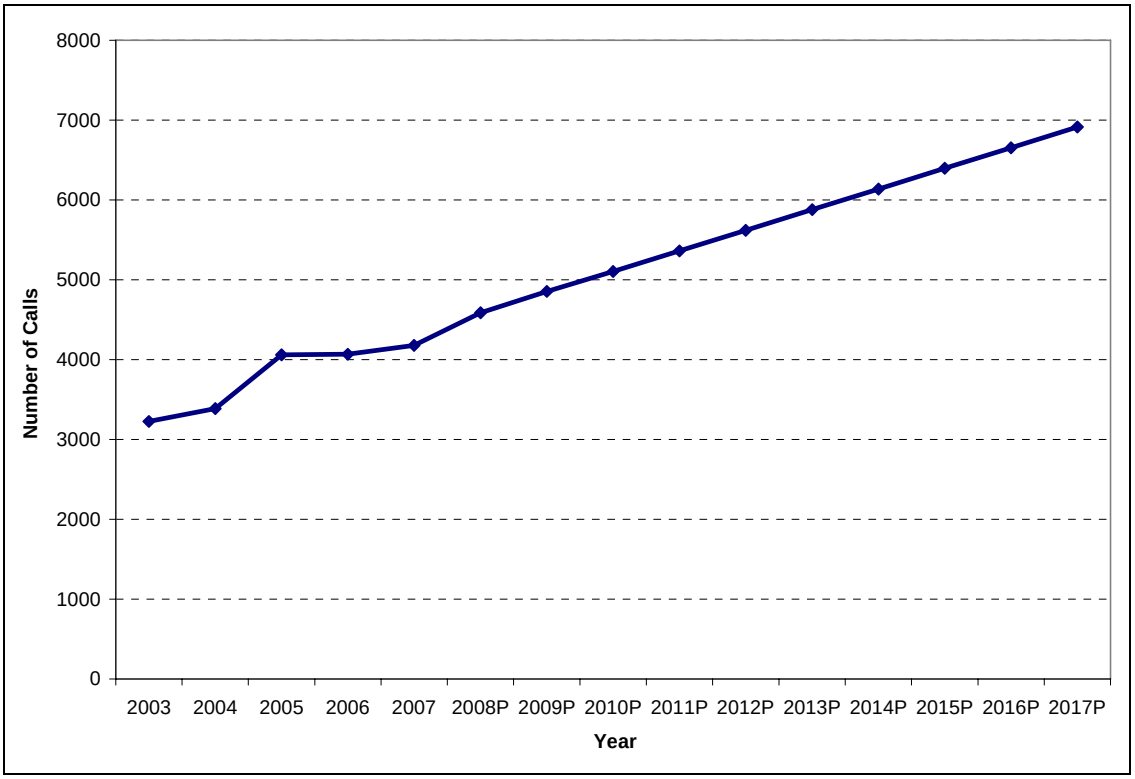


Table 54 contains the current call volume, average response time and 90th percentile response times for the Brooklyn Park area. Response times are acceptable, but increased call volume will be a challenge.

Table 54: Brooklyn Park Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
31	ALS	4178	05:29	08:28

Recommendation 32: Upgrade Engine 31 to Paramedic Engine 31. By 2009, add an Ambulance to Station 31.

BWI/Linthicum – Serves the Metropolitan Baltimore area that includes BWI-Marshall International Airport, and Linthicum, bordering Baltimore County.

Table 55: BWI-Marshall/Linthicum SWOT

Strengths	Weaknesses	Opportunities	Threats
Strong mutual aid agreements with Baltimore City, Baltimore and Howard Counties and BWI/Marshall Airport	Coverage gap in the northwest area Coverage gap west of BWI/Marshall	Improve EMS delivery by not cross-staffing the both fire and EMS units at S-34 A larger business community to garner support from	High risk of catastrophic event taking place at BWI/Marshall Airport Highly traveled, high speed roads increase the chances for transportation emergencies. Increasing industry and commerce near the airport.

Forecast 4: BWI/Linthicum[30]

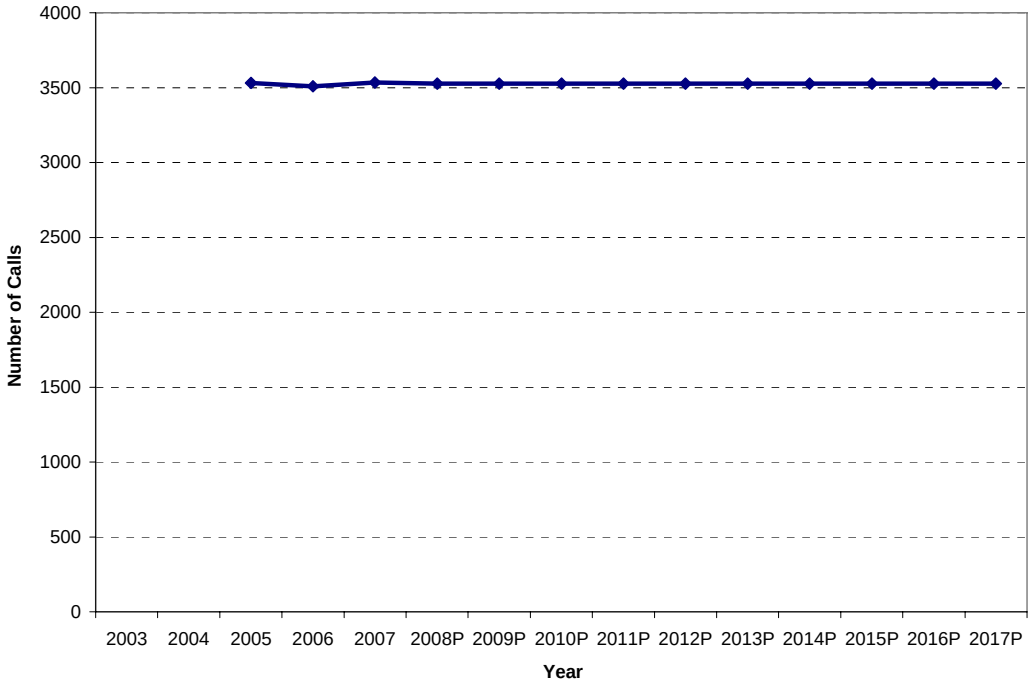


Table 56: BWI-Marshall/Linthicum Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
32	Paramedic	3535	06:11	10:00
34	BLS			

Recommendation 33: Upgrade Ambulance 34 to Paramedic. We discuss several options regarding where this unit might be deployed later in this report.

Crofton – Crofton serves the County's central and mid-west area that intersects with Odenton, Annapolis Neck, and Crownsville. EMS within the planning area is acceptable provided that the first due units are available. ALS is lacking in the Crofton community and back-up coverage is delayed. Table 57 provides a SWOT analysis for the area.

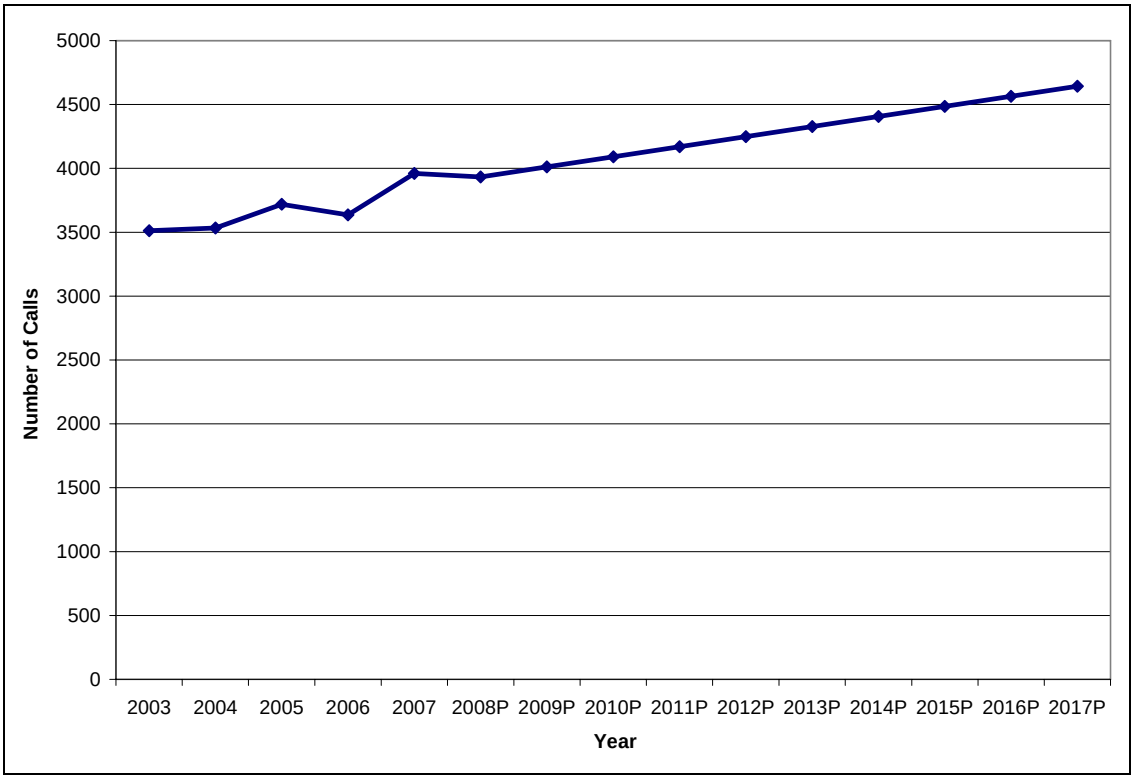
[30] In 2005, the running assignments were changed for Station 34 to improve efficiency and reduce the demand on the volunteers. For this reason, the forecast was based off of three years instead of five. While the run volume for Ambulance 34 has decreased, many of these calls were co-dispatched with other units.

Table 57: Crofton SWOT

Strengths	Weaknesses	Opportunities	Threats
EMS units are well positioned	Lack of ALS units in the Crofton area Support units have long travel times 90 percentile response time is > 11 minutes	Upgrade of services	Simultaneous requests for service could cause long response times Patient care outcomes could be affected by poor ALS coverage

The forecast for Crofton indicates a steady increase of about 5 percent annually, which may require an additional unit by 2010. Forecast 5 shows the predicted growth for the area.

Forecast 5: Projected EMS Demand for Crofton



The Crofton area has an acceptable mean response time, but a 90th percentile that is above 11 minutes, indicating that when first due units are unavailable, back-up response is delayed. Table 58 shows the response time data for the area.

Table 58: Crofton Service Delivery Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
5	Paramedic	3960	06:47	11:38
7	BLS			

Recommendation 34: Upgrade Ambulance 7 to Paramedic 7, upgrade Engine 5 to a Paramedic Engine, and upgrade Engine 7 to Paramedic Engine by 2010.

Crownsville – Crownsville includes the central part of the County with EMS provided from the Herald Harbor station. The station has a low number of responses, primarily because of its location. After relocating the station near Generals Highway and Herald Harbor Road, the number of calls should increase and the western area of Crownsville will be better covered.

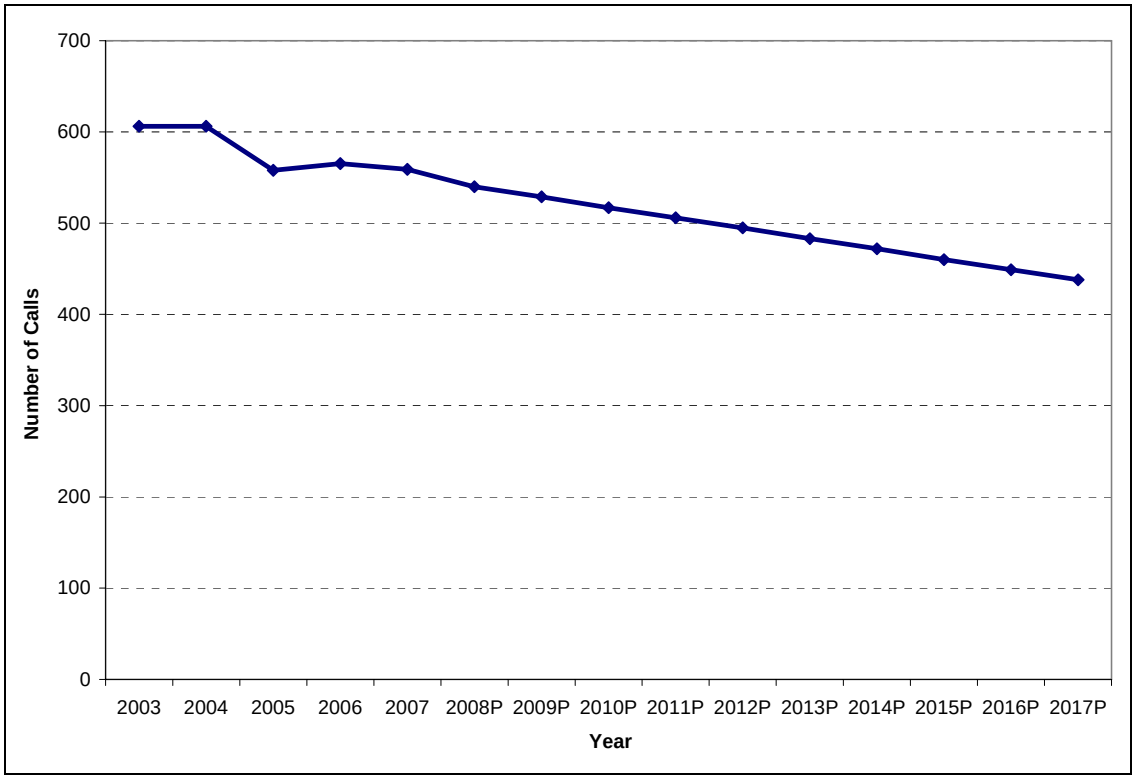
Table 59 contains the SWOT analysis for the area.

Table 59: Crownsville SWOT

Strengths	Weaknesses	Opportunities	Threats
Experience with paramedic engine concept Response time problem is recognized by AAFD	Long response times at 50th and 90th percent EMS Units are poorly positioned Support areas also have long response times	County ready to take action Improved delivery of fire and EMS to the Crownsville planning area	Reduced volunteer participation has already occurred Large service gaps that could compromise patient care

The forecast for the planning area is based on Station 6's current location. The projected decline in call volume in a County where EMS calls are increasing also signals the need to relocate the station. In a previous chapter, we recommend moving Station 6. Forecast 6 shows the EMS call forecast for the Crownsville area.

Forecast 6: EMS Demand Projection for Crownsville[31]



Response times in this area are too long. The low number of calls challenges the County to take actions other than adding more equipment and personnel. Table 60 shows the response data for the area.

Table 60: Crownsville Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
6	ALS or Medic Engine	559	08:32	14:23

Recommendation 35: Relocate Station 6 and assure full-time coverage of the Paramedic.

Deale/Shady Side – The coverage area includes the southeastern part of the County. This area is a low volume area that suffers from extended response times but a predicted reduced demand. Table 61 contains the SWOT analysis for the area.

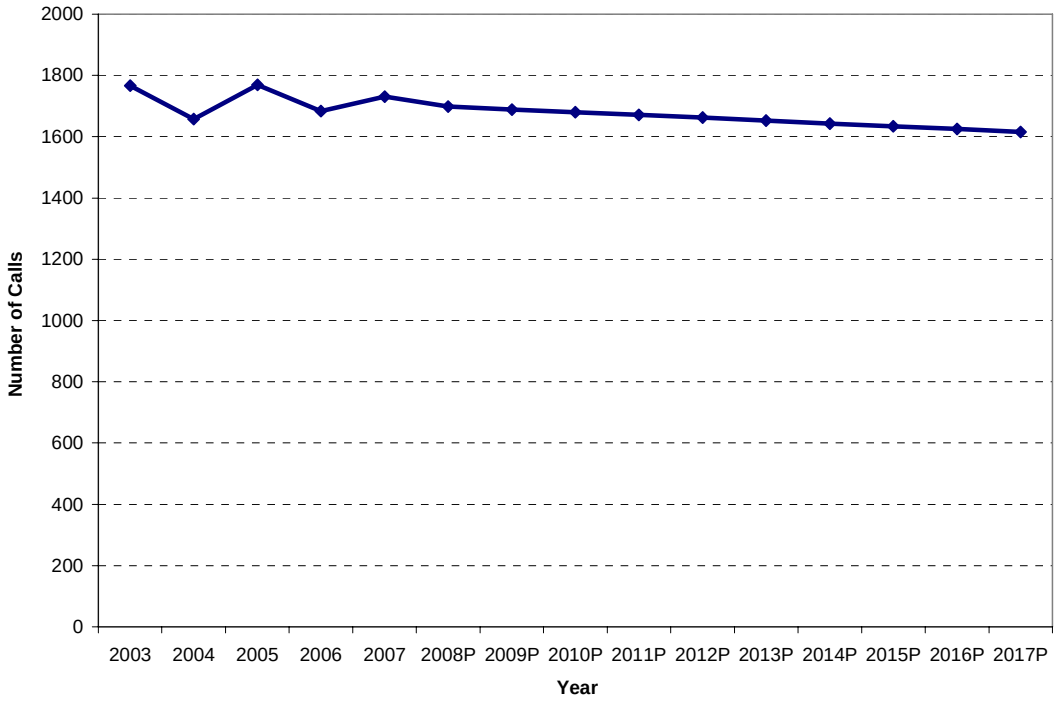
[31] The demand projecting is based on Station 6's current location. Moving Station 6 more inland will increase its demand.

Table 61: Deale/Shady Side SWOT

Strengths	Weaknesses	Opportunities	Threats
Low call volume lessens threats	Significant difference between the predicted and actual response times Lack of ALS coverage near Shady Side Coverage gaps in the area's center	Area EMS units can be upgraded Galesville and Deale EMS units should be moved west	Poor response times may compromise patient care

The Deale/Shady Side area should remain stable. Forecast 7 shows the EMS demand prediction for the area.

Forecast 7: Deale/Shady Side



Mean and 90th percentile response times are too long. If a primary unit is out, there is considerable vulnerability to longer response times. Table 62 indicates the response data for the area.

Table 62: Deale/Shady Side Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
1	Paramedic	1731	08:25	15:36
41	BLS			
42	ALS			

Recommendation 36: Upgrade Ambulance 41 to Paramedic and Engine 41 to a Paramedic Engine. Upgrade Engine 42 to Paramedic Engine by 2013.

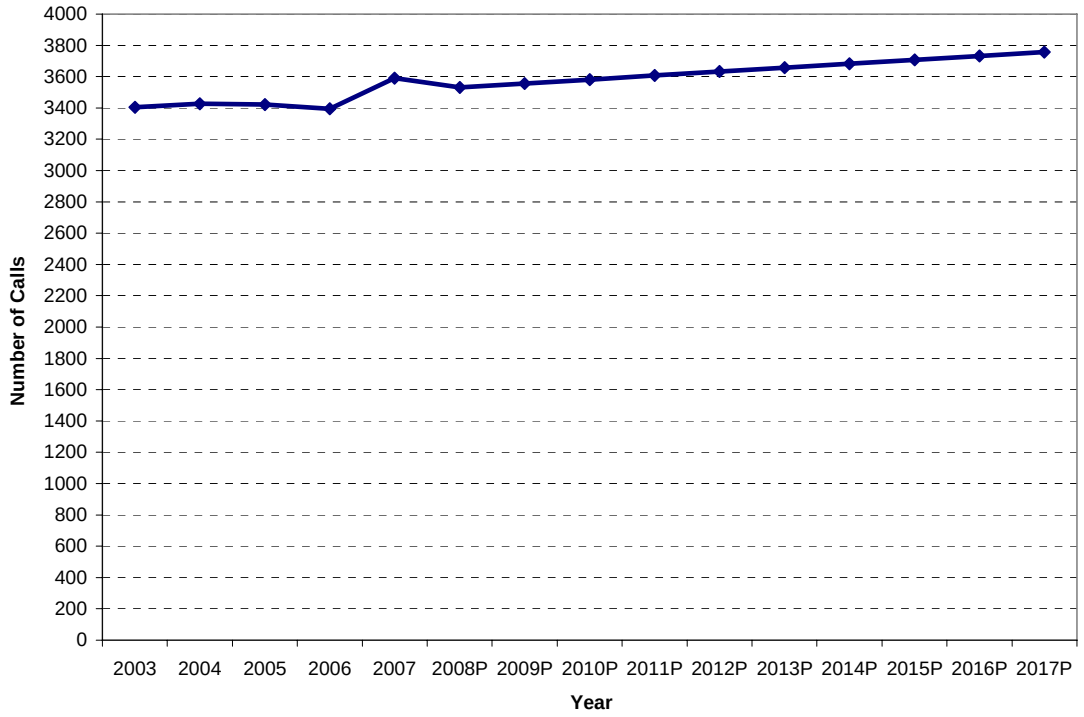
Edgewater/Mayo – Edgewater/Mayo covers the south central part of the County, south of Annapolis, between Deale/Shady Side and South County. The northern area lacks ALS coverage. Table 63 contains the SWOT analysis for the area.

Table 63: Edgewater/Mayo SWOT

Strengths	Weaknesses	Opportunities	Threats
EMS units are well positioned	Lack of ALS in the northern area Long response times due to lack of support units. 90th percentile > than 11 minutes	Units can be easily upgraded	Slight demand increase is predicted

A slight increase in demand is predicted for the area. Forecast 8 contains an EMS demand forecast model.

Forecast 8: Projected EMS Demand for Edgewater/Mayo



The average medical response time into the area is marginal, but the 90th percentile response time is too long. Based on projected demand, additional transport units are not justified.

Table 64: Edgewater/Mayo Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
2	BLS and ALS	3590	07:06	12:39
3	ALS			

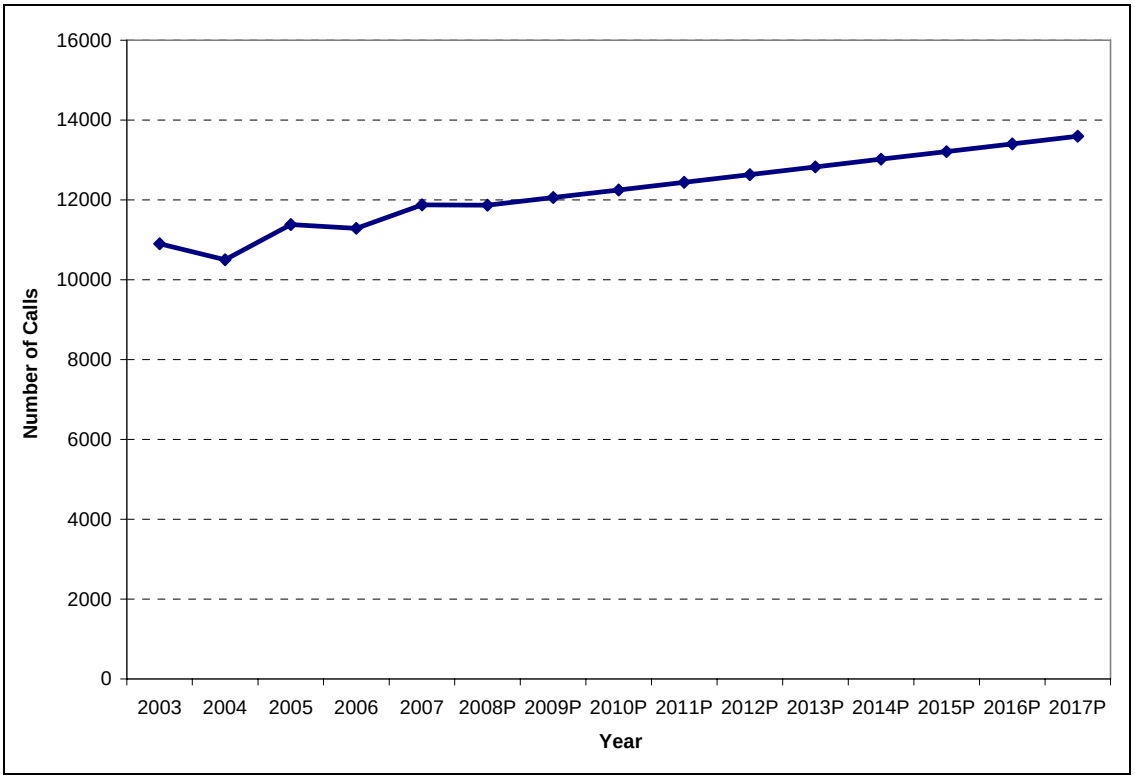
Glen Burnie – Glen Burnie covers a large population center in the northern part of the County. Decreasing volunteer participation will present more EMS challenges. Long emergency department wait times also leave the area vulnerable during busy times. Table 65 contains a SWOT analysis for the area.

Table 65: SWOT for Glen Burnie

Strengths	Weaknesses	Opportunities	Threats
Response times are acceptable	Little volunteer EMS response ALS shortage in the northeast area Large call volume in the area	Unit upgrades are available	Demand expected to continue slowly rising Long hospital turnaround times could threaten response times.

A slow increase in demand is expected, but should not cause the need for additional transport units until 2013. If hospital wait times are not improved, additional coverage may be needed sooner. Forecast 9 indicates a demand forecast for the planning area.

Forecast 9: Projected EMS Demand for Glen Burnie



Response times for the area are acceptable but should be monitored closely. The BLS unit at Station 33 should not rely on volunteers. Table 66 shows the response data for the area.

Table 66: Glen Burnie Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
18	ALS	11875	05:05	08:54
26	ALS			
33	ALS and BLS (Volunteer) [2 units]			

Recommendation 37: Upgrade Engine 33 to Paramedic Engine 33. Add an Ambulance to Station 18 in 2009. Prepare to add a Paramedic in the area by 2013 (New Glen Burnie station)

Jessup/Maryland City – Jessup/Maryland City serves the northwestern part of the County, bordering Howard County, Prince Georges County, and Fort Meade. The planning area presents challenges as the extent that BRAC will increase EMS demand is still unknown. Lack of

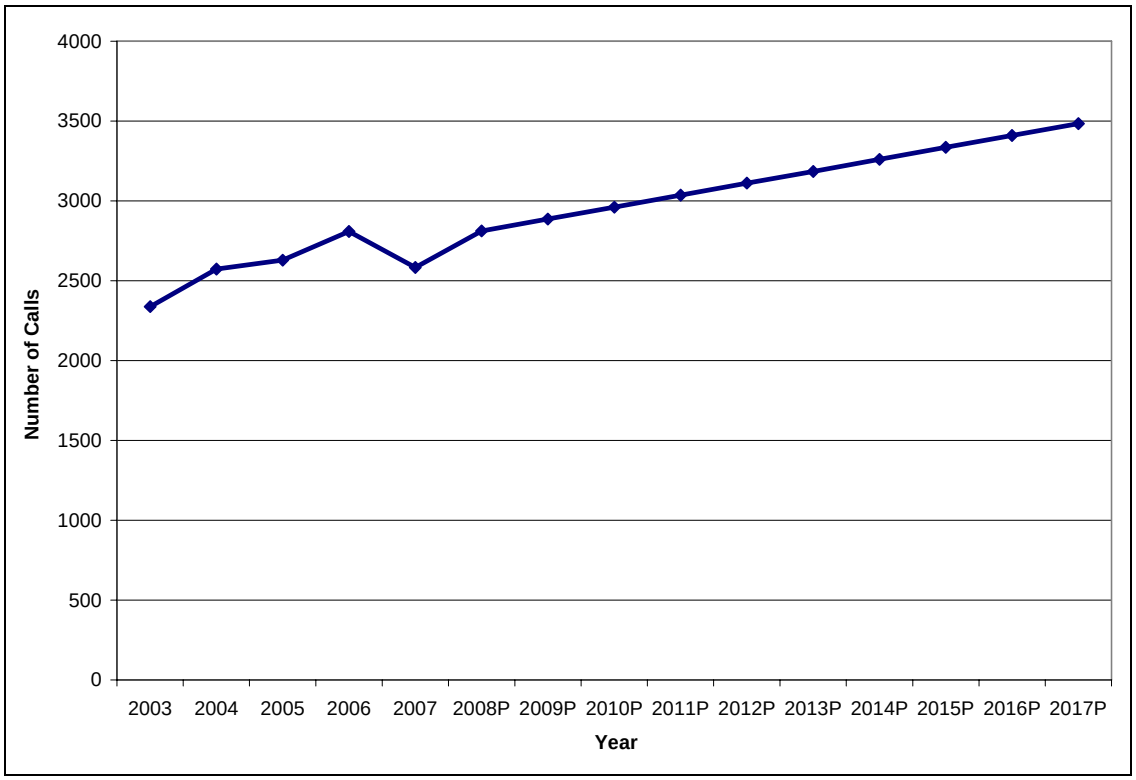
ALS in the western area, decreasing volunteer participation, and a possible move for the Odenton station may affect plans for the area. Table 67 contains the SWOT analysis for the area.

Table 67: SWOT for Jessup/Maryland City

Strengths	Weaknesses	Opportunities	Threats
Good mutual aid from counties and Fort Meade	Long response times with 90th percentile > 11 minutes Lack of ALS in the western area Volunteer participation continues to decline	BRAC may help justify additional EMS services	At higher risk for terrorist incidents BRAC may add additional EMS demand Odenton area may experience station move, reducing support

The forecast for Jessup/Maryland City is based on current conditions without regard to BRAC or other events. A seven percent annual increase should be expected to occur in the area, thus the engine and paramedic units should independently staffed. Forecast 10 shows the EMS demand forecast for the area.

Forecast 10: Projected EMS Demand for Jessup /Maryland City



The mean EMS response time is acceptable, but the 90th percentile time is too long. Increasing call volumes in Severn may extend response times when the first due units are out.

Until the County gets a better indication of BRAC's effect, efforts should be concentrated on shoring up some vulnerable areas. Call volumes should continue to be monitored.

Table 68: Jessup/Maryland City Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90% RT
27	ALS	2582	06:31	11:23
29	ALS			

Recommendation 38: Beginning in 2009, provide independent staffing for the paramedic unit at Station 27. In 2010 and 2013, upgrade the engines at Station 29 and 27 to paramedic engines, respectively.

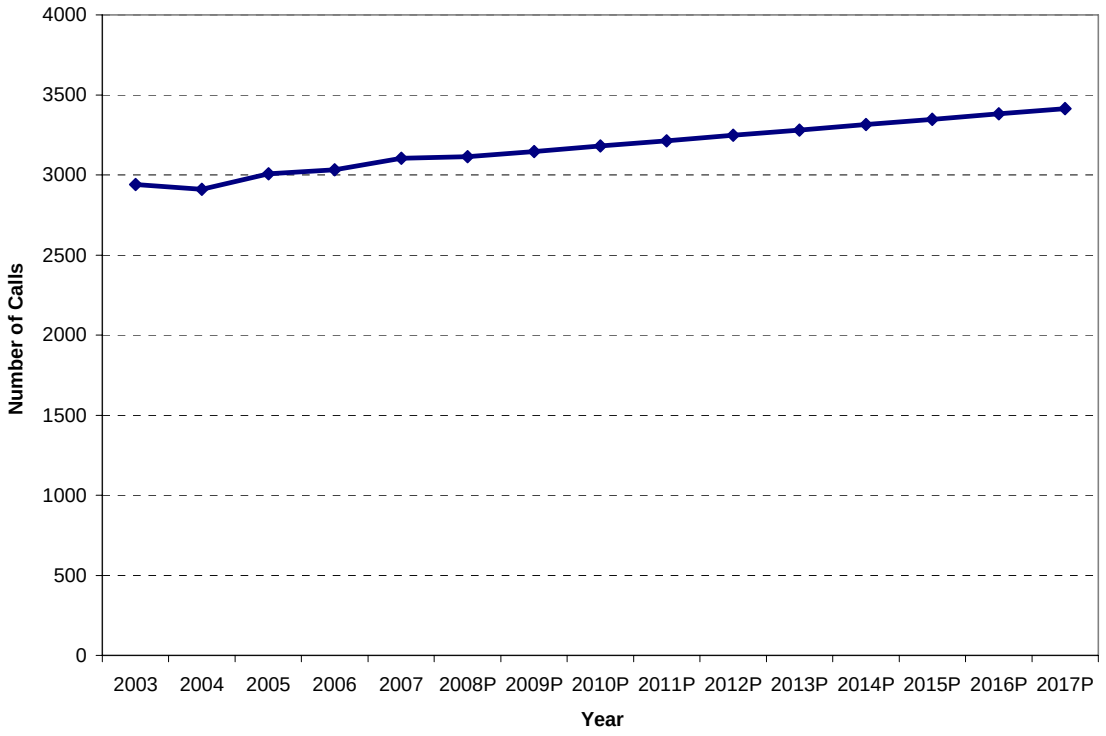
Lake Shore – The area covers the Northeastern part of the County, including Gibson Island. The northeastern and southeastern sections are especially vulnerable to longer response times. BRAC could increase EMS demand for the area. Table 69 contains the SWOT analysis for the area.

Table 69: SWOT for Lake Shore

Strengths	Weaknesses	Opportunities	Threats
Good support in northwest area	Long response times to northern area and Gibson Island ALS response times are longer in northern and eastern areas Volunteers are unable to meet demands	Repositioning of units	Slow but steady demand increase BRAC may have an effect on the area

A slow, but steady EMS demand increase is predicted for the area. Relocating Station 20 and upgrading Ambulance 20 to ALS should allow the County to handle the demand increase. Forecast 11 contains a demand forecast for the area.

Forecast 11: Projected EMS Demand for Lake Shore



EMS response times are within reason but should continue to be monitored.

Table 70: Lake Shore Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
10	ALS	3105	06:18	10:31
20	BLS (Volunteer)			

Recommendation 39: Upgrade Ambulance 20 to Paramedic 20.

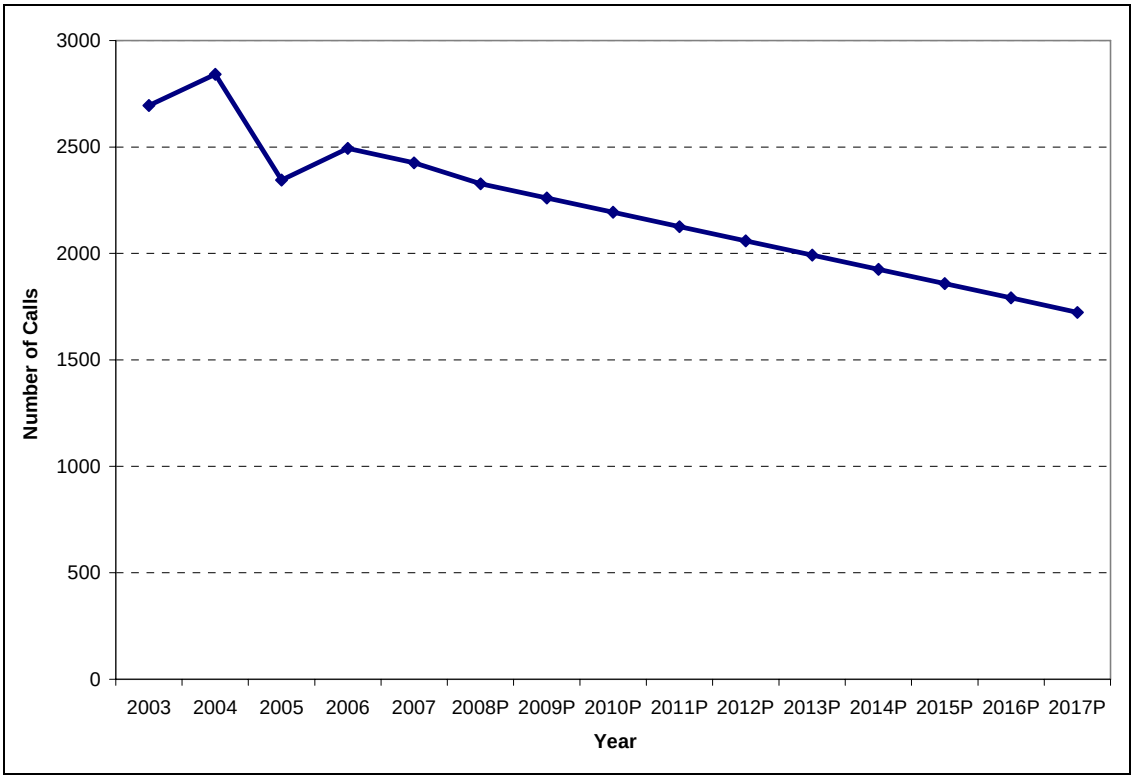
Odenton – The Odenton Planning Area includes the central section of the County and provides mutual aid to Fort Meade. Highway construction due to BRAC may force the station to be moved. There is a lack of ALS service available to the area that should be corrected. Table 71 contains a SWOT analysis for the area.

Table 71: Odenton SWOT

Strengths	Weaknesses	Opportunities	Threats
Excellent volunteer coverage, including assigned crews	Lack of ALS Station is not optimally located Poor coverage in west/southwest area	Moving station could improve coverage An EMS station could provide a low-cost upgrade for the area ALS unit may be better positioned to the southwest	Roadway construction due to BRAC could force the station to move BRAC could increase EMS demand BRAC could cause Fort Meade to need additional mutual aid

The predicted decrease in EMS demand is misleading. In 2005, the Severn unit was assigned a significant part of an area once covered by Odenton. BRAC's unknown effect must also be considered. Like in the adjacent Jessup/Maryland City area, a cautious approach should be taken before committing additional resources. Forecast 12 includes an EMS demand analysis for the area.

Forecast 12: Projected EMS Demand for Odenton[32]



[32] The forecast for Odenton may be questionable since changes in running assignments and BRAC were not considered. Also, some of the area began to be served by Severn.

The response times for the area are within reason. Table 72 includes the response times for the Odenton Planning Area.

Table 72: Odenton Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
28	BLS (Volunteer)	2425	06:15	10:10

Recommendation 40: Add Paramedic 28, with the volunteers continuing to staff Ambulance 28.

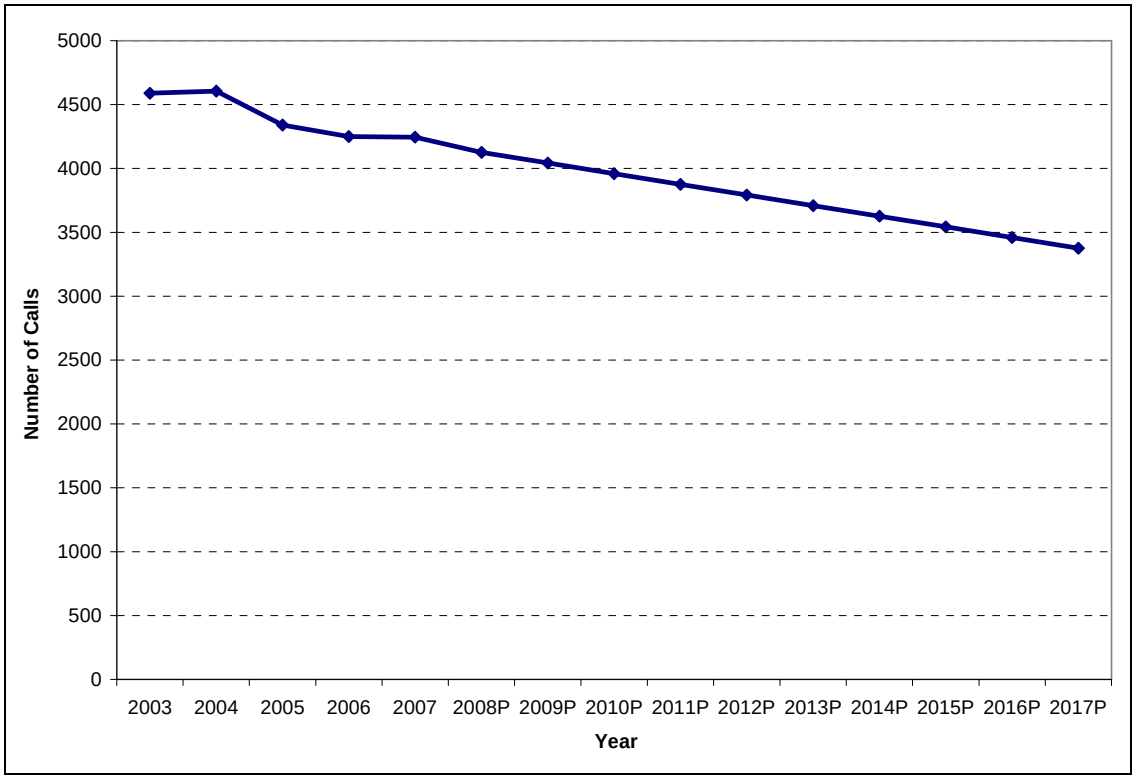
Pasadena/Marley Neck – Pasadena/Marley Neck includes part of the central section of the County. Lack of ALS in the northern area is the only obvious concern. Table 73 contains a SWOT for the area.

Table 73: Pasadena/Marley Neck SWOT

Strengths	Weaknesses	Opportunities	Threats
EMS units are available Relatively good EMS response times Support areas can readily access the area	Lacks ALS in the northern area	Units can be easily upgraded Demand is slightly decreasing	A large residential development is planned along Marley Neck Road Other 55+ communities may also be planned for this area, according to the fire department

The demand analysis estimates a three percent decrease in calls annually. This forecast should be cautiously considered as new construction and residences may change the forecast. Forecast 13 contains the EMS demand analysis for the area.

Forecast 13: Projected EMS Demand for Pasadena/Marley Neck



Response times for the area are acceptable. Table 74 contains the response data for the area.

Table 74: Pasadena/Marley Neck Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
11	BLS	4245	05:21	09:52
13	BLS and ALS (company of 4)			
30	ALS			

Recommendation 41: Continue to monitor the area for changes in demand patterns.

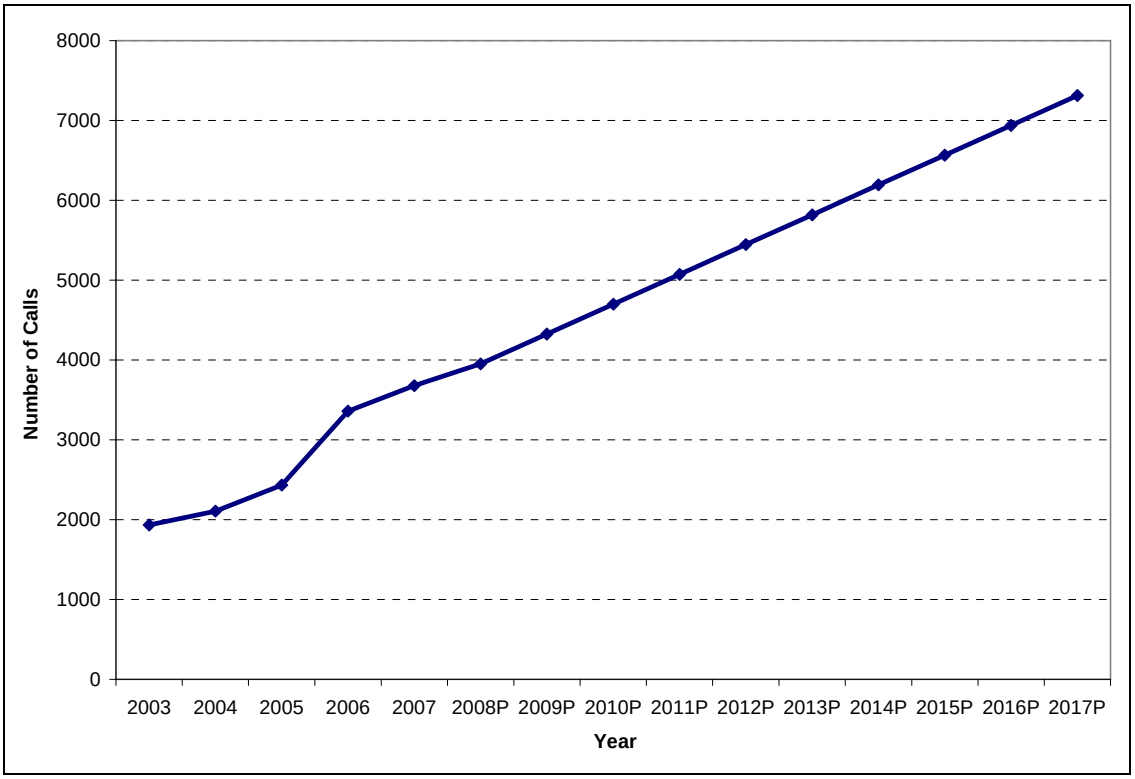
Severn – Severn serves the north-central part of the County adjacent to Odenton. The BRAC program is likely to affect demand in the area, but the extent is unknown. Regardless, demand in Severn is likely to increase by 10 percent annually. Table 75 contains a SWOT analysis for the area.

Table 75: Severn SWOT

Strengths	Weaknesses	Opportunities	Threats
Good ALS support except for the southern area	ALS in the southern area 90th percentile response times are > 11 minutes	Potential to use alternate EMS delivery methods	Service demand continues to rapidly grow BRAC and airport expansion may increase demand

The forecast calls for a continued sharp rise in EMS demand over the next 10 years. Changing of response boundaries and BRAC are the major variables for change. Additional ALS transport units will be needed by 2011 and 2014. Forecast 14 contains the EMS demand analysis for the area.

Forecast 14: Projected EMS Demand for Severn



The mean response times are acceptable, but the 90th percentile response times are too long. In addition, projected call volumes in the Severn planning area will continue to increase substantially.

Table 76: Severn Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
4	ALS	3677	06:19	11:09
21	ALS			

Recommendation 42: Upgrade Quint 4 and Engine 21 to paramedic engines. In addition, add a career ambulance unit at Station 21 now and a second paramedic transport unit to Station 4 by 2013.

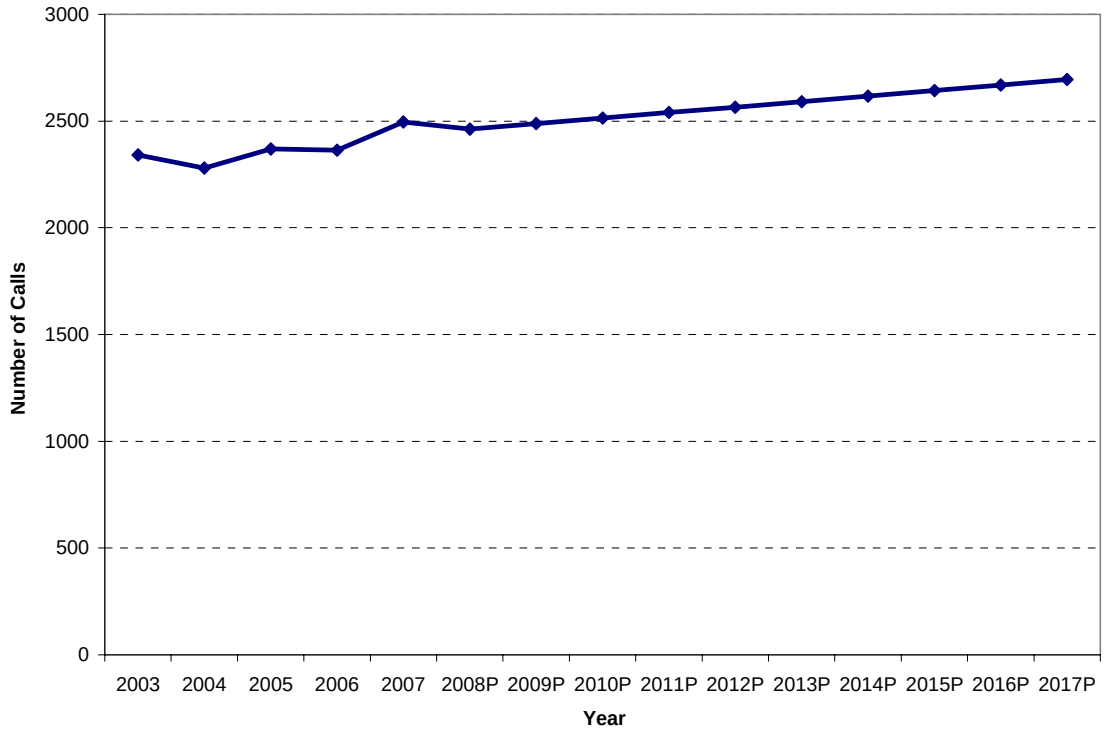
Severna Park – Severna Park includes the south-central part of the County. Call volumes are slowly increasing, and ALS support is weakest in the southeastern and western areas. Table 77 contains a SWOT analysis for the area.

Table 77: Severna Park SWOT

Strengths	Weaknesses	Opportunities	Threats
EMS unit is well positioned	ALS support is weak in the southeast and western areas		Call volume continues to slowly increase

EMS demand in Severna Park should increase steadily at about 1 percent annually. This should not stress the area, but Paramedic Engine support will likely be needed by 2014. Forecast 15 contains an EMS demand projection for the area.

Forecast 15: Projected EMS Demand for Severna Park



The response times for the area are adequate but should continue to be closely monitored. Table 78 contains the response data for the area.

Table 78: Severna Park Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
12	Paramedic	2496	06:12	10:37

Recommendation 43: By 2014, upgrade Engine 12 to a Paramedic Engine.

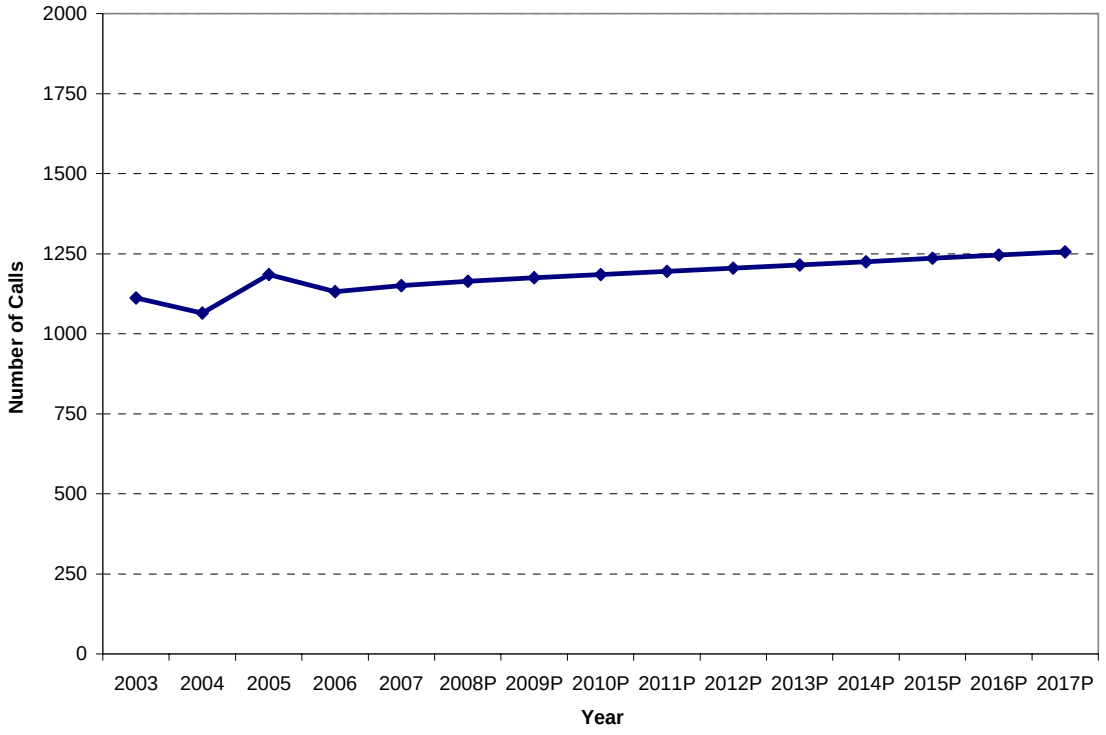
South County – South County includes the southern part of the County. The largest areas of vulnerability include the southern and western areas. Although available, mutual aid support is not guaranteed. Table 79 contains a SWOT analysis for the area.

Table 79: South County SWOT

Strengths	Weaknesses	Opportunities	Threats
Relatively stable call volume	Poor response times at the 50th and 90th percentile Mutual Aid not as strong Southern and western areas especially vulnerable	Making changes in South County and Deale/Shady Side could be mutually beneficial	Extremely long response times, especially if the primary unit is not available

EMS demand is predicted to rise by about 2 percent annually, which itself is not remarkable, but when combined with long transport times, could increase vulnerability. Forecast 16 contains an EMS demand analysis for the area.

Forecast 16: EMS Demand for South County



The mean and 90th percentile times for the area are too long. Relocation of units in Deale/Shady Side may help offset these deficiencies. Upgrading Engine 9 to a Paramedic Engine may also help in vulnerable areas. Call volume itself does not warrant additional units. Table 80 contains response data for the area.

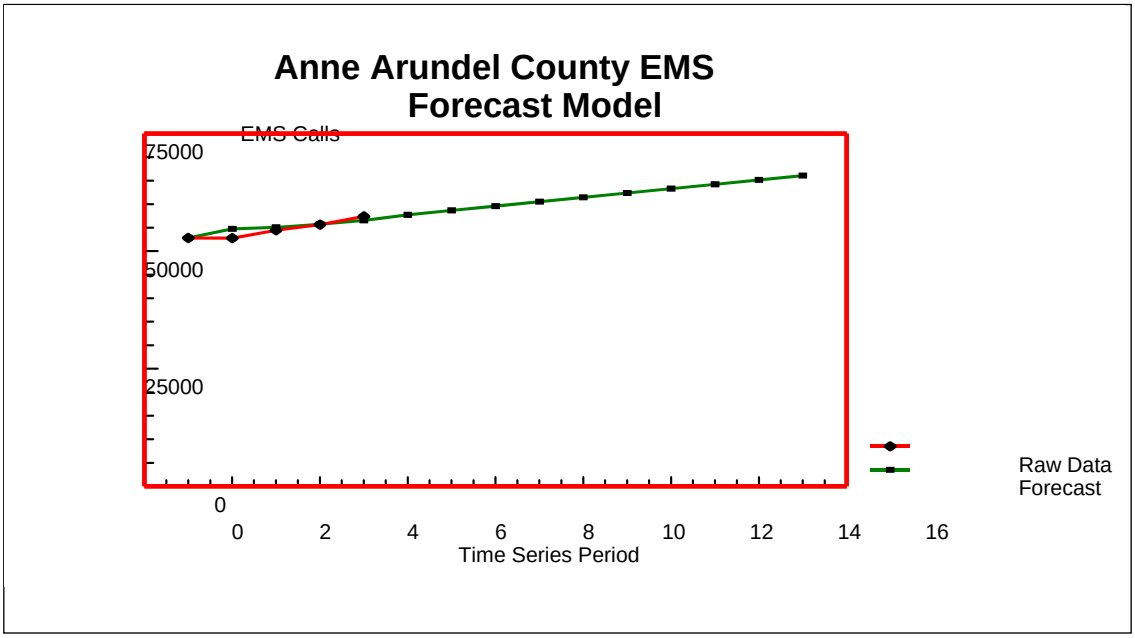
Table 80: South County Service Area

Stations	Units	Total EMS Calls (2007)	EMS Avg. RT	EMS 90 % RT
9	Paramedic	1150	09:13	13:28

Recommendation 44: Upgrade Engine 9 to a Paramedic Engine.

Countywide EMS Forecast – Based on EMS calls between 2002 and 2006, Figure 12 contains a forecast for EMS calls through 2015. Excluding BRAC and other effects, a consistent annual increase of ~ 1.5 percent can be expected. Although the number reads small, in 10 years, the EMS call volume will likely increase from 57,389 to 66,075.

Figure 12: Anne Arundel County EMS Forecast Model



Summary for EMS Response

EMS service response is summarized in Table 81.

Table 81: Summary for EMS Demand and Response

Planning Area	Demand Forecast	50th percentile Time	90th percentile Time
Annapolis Neck	Increase – 8% annually	Acceptable	Too long
Broadneck	Stable	Acceptable	Acceptable
Brooklyn Park	Increase – 10% annually	Acceptable	Acceptable
BWI/Linthicum	Stable	Acceptable	Acceptable
Crofton	Increase – 5% annually	Acceptable	Too long
Crownsville	Stable	Too long	Too long
Deale/Shady Side	Stable	Too long	Too long

Planning Area	Demand Forecast	50th percentile Time	90th percentile Time
Edgewater/Mayo	Increase annually – 1%	Marginal	Too long
Glen Burnie	Increase – 3% annually	Acceptable	Acceptable
Jessup/Maryland City	Increase – 7% annually	Acceptable	Too long
Lake Shore	Increase – 1% annually[33]	Acceptable	Too long
Odenton	Stable[34]	Acceptable	Too long
Pasadena/Marley Neck	Stable	Acceptable	Acceptable
Severn	Increase – 10% annually	Acceptable	Too long
Severna Park	Increase – 1% annually	Acceptable	Acceptable
South County	Stable	Too long	Too long

Summary of Proposed EMS Changes by 2014 – Table 82 contains a summary of EMS changes to be accomplished by 2014. Included are the projected year of the change and the total number of paramedic needed to operate daily. All changes are additions unless contained in brackets [ ].

Table 82: Proposed EMS Changes by 2014

Planning Area	Changes	Paramedics Needed Daily
Annapolis Neck	Add: Paramedic at Station 8 Add: Paramedic Engine at Station 8 Upgrade Engine 40 to Paramedic Engine	4
Broadneck	Add: Paramedic to Station 23 Upgrade: Quint or Squad 23 to a Paramedic Squad	3
Brooklyn Park	Upgrade: Engine 31 to Paramedic Engine Add (2009): Ambulance to Station 31 Add (2014): Paramedic to Station 31	2 3 (2014)
BWI/Linthicum	Upgrade: Ambulance 34 to Paramedic	1
Crofton	Upgrade: Engine 5 to Paramedic Engine Upgrade (2010): Engine 7 to Paramedic Engine	3 4 (2010)
Crownsville	No change	1
Deale/Shady Side	Upgrade: Ambulance 41 to Paramedic Upgrade: Engine 41 to Paramedic Engine Upgrade (2013): Engine 42 to Paramedic Engine	2 3 (2013)
Edgewater/Mayo	No change	2

[33] BRAC influence may make this forecast low.
[34] BRAC is likely to influence this forecast.

Planning Area	Changes	Paramedics Needed Daily
Glen Burnie	Upgrade: Engine 33 to Paramedic Engine Add (2009): Ambulance to Station 18 Add (2013): Paramedic to the new Glen Burnie Station	4
Jessup/Maryland City	Upgrade (2010): Engine 29 to Paramedic Engine Upgrade (2013): Engine 27 to Paramedic Engine	2 3 (2010) 4 (2013)
Lake Shore	Upgrade: Ambulance 20 to Paramedic	2
Odenton	Add: Paramedic 28 (career)	1
Pasadena/Marley Neck	No change	2
Severn	Upgrade: Quint 4 to Paramedic Quint Add : Ambulance to Station 21 Add (2013): Paramedic to Station 4	3 4 (2013)
Severna Park	Upgrade (2014): Engine 12 to Paramedic Engine	1 2 (2014)
South County	Upgrade: Engine 9 to Paramedic Engine	2

Included above are specific recommendations concerning career ambulances. Ambulances should be staffed by 2 FF/EMT-Bs (FF II) and could be staffed either 24/7 or on a weekday, 10 hour, 40 hour per week shift.

Figure 13: Staffed BLS Unit Recommendations

Station	Year	Priority
Station 18	2009	High
Station 31	2009	High
Station 21	2011	High
Station 40	Monitor Station 8's effect then decide	Low
Station 23	Depends on service provided by Medic (Hazmat 23)	Low
Station 3	Reevaluate annually	Low
Station 5	Reevaluate annually	Low

Staffing Implications – Looking at the big picture, these recommendations would collectively add 21 paramedic-capable ambulances or engines. However, the number of paramedics needed is less than required now because we change paramedic units to one paramedic and one EMT. The number of paramedics will increase back to 36 in 2010, 39 by

2013, and to 41 by 2014. By 2014, the county will have 28 additional units providing paramedic service, but only need three additional paramedics on-duty per shift.

Medical Direction – Dr. Roy Myers has served for many years as the county EMS medical director. He spent much of his career as a surgeon, critical care specialist, and director of the hyperbaric medicine program at the University of Maryland Shock-Trauma Center. Being close to the cutting edge of emergency and critical care medicine, his talent has afforded the department quality EMS medical direction. He has been an active medical director, working closely with the administration and the street level providers. Dr. Myers' contract includes malpractice coverage, but he serves without salary. There have been various assistant medical directors, with the latest being an emergency medicine specialist at Baltimore-Washington Medical Center.

During our interview, Dr. Myers advised that he has retired from full-time medical practice, restricting his practice to consulting and EMS medical direction. He believes that an EMS medical direction succession plan is needed, and that future medical directors will likely require monetary compensation for their services. His views are shared with professional organizations including the American College of Emergency Physicians, the American Academy of Emergency Medicine, and the National Association of EMS Physicians.

The medical director has some definite thoughts and concerns about AA County EMS including:

- Critical patients benefit from two ALS providers but some patients receive good care from one ALS provider.
- ALS providers on transport and non-transport units are acceptable provided that patients receive timely and appropriate care.
- Career Basic Life Support ambulances are acceptable, but should be staffed by dual role/cross-trained firefighter-EMTs.
- EMS dispatch needs to be reinforced in order to provide appropriate pre-arrival instructions and send the right units. Dispatchers should be taught to develop better judgment skills. There also needs to be dedicated supervision for EMS dispatch and quality management.
- The department needs three full-time EMS supervisory units.
- The EMS education and training section is understaffed and better training facilities are needed. There is a possibility that MIEMSS may not recertify the fire academy as an EMS training site. [Although assessing EMS training was outside the scope of

work prescribed by the county for this project, we mention this concern since it could affect EMS operations]. The department has approval to takeover the space currently occupied as the Eastern District Police Station, when they vacate the space. While there is no funding for modifications, this space is intended to be used for EMS training.

- Time needed to transfer patients to hospital staff care after arrival at the emergency department is too long. The emergency departments must take more responsibility for patient flow.
- Volunteer participation continues to decline. Off duty career providers should be allowed to volunteer.
- Fee-for-service is acceptable provided that the revenue be used to support EMS. The total EMS budget should not be based on fee-for-service revenue.

EMS Management and Supervision – The EMS Division is part of Emergency Operations. It is under the command of a division chief, who reports to the deputy chief of operations. EMS personnel are dual role/cross trained and report through the operations chain of command. There are 9 EMS supervisory and 5 EMS training personnel who report to the EMS Division Chief.

There are two, 24-hour and one 8 hour, weekday EMS supervisors on-duty who supervise EMS care and quality management responsibilities. They also provide advanced, medication assisted, airway management, known as rapid sequence intubation (RSI) to extremely critical patients. The EMS supervisors-are responsible for patient care quality, loss control procedures, EMS diagnostic and therapeutic devices, and patient care reports. They also take on ICS roles during multi-casualty incidents and can provide ALS care when needed.

The expanding role of EMS supervisors, especially with increased call volume, system complexity, emergency department overcrowding and an new electronic patient care reporting program will increase the need for EMS supervisory presence in the field. These developments and the county geography warrant the presence of one TRO in each battalion. An eight-hour TRO no longer provides the best EMS supervisory coverage.

Recommendation 45: Upgrade the eight-hour EMS Supervisor to a 24/7 position.

Quality Management – The department's adoption of an electronic-based patient care report (E-PCR) should improve EMS quality management capabilities. The availability of real-time data allows the department to develop benchmarks that measures several aspects of EMS delivery.

Traditionally, EMS systems that measured performance were limited to response times and cardiac arrest survival. While response times are politically sensitive, their validity is often questionable. In many cases, rapid first response may justify slower response times for transport vehicles. Cardiac arrest survival is an important measurement, but its relatively low numbers and inherent negative probability of success, limits usefulness. Recently, the 2007 Consortium U.S. Metropolitan Municipalities' EMS Medical Directors reviewed the scientific literature on EMS interventions to develop a set of EMS benchmarks that are valid indicators of performance.[35] These benchmarks include the elements described in Table 83.

Table 83: Essential EMS Benchmarks[36]

Clinical Area	Performance Benchmark
S-T Elevation Myocardial Infarction (STEMI)	Administration of Aspirin (ASA), if not allergic Acquiring 12-Lead ECG Communicate accurate results of 12-lead ECG Pre-activation of hospital interventional cardiology team Direct patient transport to a facility capable of accomplishing ECG to percutaneous coronary intervention (PCI) in < 90 minutes
Pulmonary Edema (Cardiac)	Nitroglycerin, unless contraindicated Noninvasive Positive Pressure Ventilation (NIPPV) such as CPAP, as first-line therapy to avoid the need for endotracheal intubation
Asthma	Administration of a beta-agonist agent by the first qualified EMS provider
Seizures	Blood glucose measurement Identification of patients whose generalized seizure activity is longer than 15 minutes, or experiences 2 or more seizures without an intervening period of clear mental status Administration of a benzodiazepine by the best available route (IV, IM, rectal, or intranasal)
Trauma	Limit on-scene, non-entrapment time to < 10 minutes Direct transport to trauma center for patients meeting the American College of Surgeons trauma center triage criteria, especially patients over 65 years old
Cardiac Arrest	Response interval of < 5 minutes for basic CPR and automatic external defibrillator (AED)

Although other benchmarks could be measured, the above represent measurable and valid interventions.[37] These should be considered a beginning point for all EMS systems. Table 83 only identifies benchmarks, and is not intended to identify the entire scope of practice.

[35] Myers, J.B., Slovis, C.M., Eckstein, M., Goodloe, J.M., Isaacs, S.M., Loflin, J.R., Mecham, C.C., Richmond, N.J., & Pepe, P.E. (2008). Evidence-Based Performance Measures for Emergency Medical Services Systems: A Model for Expanded Benchmarking. *Prehospital Emergency Care, 12*, 141-151.
[36] Ibid., p. 144.

An advanced EMS system like Anne Arundel County should measure additional benchmarks. These should be determined by the EMS Staff and the medical director, and be data driven.[38]

Recommendation 46: Measure the benchmarks indicated in Table 83 and consider developing additional benchmarks deemed necessary by the EMS staff.

Technological Considerations – The adoption of an electronic patient care report (E-PCR) is a seminal event for the department in its ability to accurately measure time intervals and patient care intervention data. The E-PCRs are only part of the technological inventory needed to evaluate patient care. System-based actions are needed to assure data accuracy. The measurement of time intervals continues to challenge the validity of EMS data measurement. Uniform time intervals, availability of data and accuracy of data collection continues are a few of the specific challenges associated with time.

Fortunately, new CAD and E-PCR technologies allow for greater system integration between data collection devices. Unfortunately, failure to recognize or marry these technologies leads to inaccurate and disappointing results. Maximum gains occur when CAD data directly populate E-PCRs with time, location and other measurements.

Recommendation 47: The CAD system should be capable of directly populating the E-PCR with appropriate time and location data. Failure to adopt this systematic approach will result in less than desired data accuracy. The county should consider this a high priority when implementing any CAD changes.

EMS Stations – The County is concerned about the rising cost of fire stations, some that exceed several million dollars. They inquired about the advantages of stations that may house only EMS units. Besides financial savings, these stations could be strategically located to areas whose EMS demand is high, but whose fire activity is low.

At this time, the county would not significantly benefit from EMS-only stations. In general, station locations are good for both EMS and fire protection. At this time, our EMS recommendations call for stationing EMS units in traditional fire/EMS stations. The only exception may be Paramedic 34, depending on decisions made concerning Station 34's future. In the future, however, EMS-only stations may have a place in the county.

[37] Emergency Services Best Practices. (2008). Consensus Group Recommends Benchmarks for EMS. [On-line version]. *Best Practices in Emergency Services*. Available: www. Emergencybestpractices.com, pp. 1-2.
[38] The Maryland Institute for Emergency Medical Services Systems protocols may serve as a guide to determine additional benchmarks.

Hospital Turnaround Times – Many EMS systems, including Anne Arundel County, are experiencing excessive turnaround times after transporting a patient to an emergency department. Many patients who are not critical are not quickly placed in an emergency department bed or other area, and left in the care of the EMS unit personnel for a while.

Turnaround time is measured from the time of arrival at the emergency department until the EMS unit is back in service, ready to answer another call (even if from the hospital it is at). The county reported an average turnaround time of 44 minutes. While there are no specific turnaround time standards, many EMS systems strive for a goal of 20 minutes.

Longer times at the hospital result in less unit availability, meaning more units being needed. The issue of turnaround times is sensitive that often leads to friction between the hospitals and the EMS system. Many political leaders and fire chiefs are reluctant to address the issues. EMS regulatory agencies have attempted to mitigate the problem by implementing bypass or redirect programs. While these solutions have some merit, they are costly to EMS and do not place the burden on the responsible party; the receiving hospital. They also set-up a customer service issue for the department as patients and physicians experience logistical and financial impositions.

From a legal prospective, once a patient arrives on hospital property, the hospital is responsible for patient care. Failure to meet that responsibility violates federal EMTALA (anti-dumping) laws. In many EMS systems, delays in the hospital *accepting* the patient requires a longer EMS turnaround time. In summary, the fire department is required to mitigate the emergency department throughput problems when it should not have that responsibility.

Tight budgets, reduction in state appropriations and increased operational costs are now forcing elected officials and fire chiefs to address this sensitive issue. The political subdivision can no longer afford to be burdened with this hospital issue, whether caused by lack of beds or lack of nursing staff. In Orange County, FL, hospitals have started hiring *off-load paramedics,* who are paid by the hospital to monitor patients until beds become available. The *off-load paramedic* is another mitigation effort for use until global changes are enacted in the EMS and entire health care system. Its benefit to the county is shifting the cost of mitigating system inefficiency to the legally responsible party.

Recommendation 48: Anne Arundel County should work with MIEMSS and local hospitals to create an off-load paramedic program, where the hospitals hire or pay local fire departments to supply additional personnel during peak times. A concept like this will require a new level of cooperation and sensitivity between all EMS system constituents.

EMS Finances

Providing EMS first response and transportation is a costly endeavor felt by most governments providing these services. Traditional tax-based models have given way to fee for service based models, shifting the financial burden from the taxpayer to the individual user or their medical insurance provider.

This section will explain the tax-based and fee for service models and predict the possible revenue windfall available to Anne Arundel County. We also identify the implications of fee for service models and considerations for implementing fee for service.

Tax-Based Model – Many municipal EMS systems are funded through a tax-based model. EMS agencies are allotted money from the local government, usually based on a specific, tax supported line item. Similar models are directly funded a district tax earmarked for EMS or fire/EMS services. User fees are not collected on a per-call basis.

Government leaders and citizens have many views on the role of government in providing emergency medical services. Some believe that EMS is a public safety responsibility, while others believe that it should be part of the health care system, and funded similarly to health care.

There does not appear to be a specific right or wrong answer, but a community-based decision that is based on priorities of local government and its citizens. There are variations of the tax-based model that combine several methods of funding options as explained below.

Fee for Service Model – An alternative to a traditional tax-based system, some local governments consider preparedness and initial response as covered by taxes. The transportation element is funded by user fees, many of which are covered by medical insurance premiums. For example Medicare and Medicaid benefits are already paid for by taxes. Indemnity or managed care insurance plans already calculate the cost of ambulance service into their premiums. This revenue can be captured by the county instead of reverting back to the federal government or insurers.

Projected Revenues – The potential earnings from fee for service EMS were calculated using the federal classification system for ALS I, ALS II, and BLS calls. The number of calls in each category was then reduced to 65 percent to account for a typical 35 percent rate of non-transport. This method allowed us to estimate the potential number of calls eligible for reimbursement (Table 84).

CMS classification of calls is based on the federal definition of ALS or BLS. Some ALS I calls would be operationally considered BLS calls. ALS II calls are the most serious call and usually require significant use of airway equipment, medications and other advanced procedures.

Table 84: Estimated Number of Transported Emergency Calls per Year, by Service Types

Care Type	2003	2004	2005	2006	2007
BLS	7877	10627	10781	10555	10622
ALS I	18469	16480	17080	17753	18655
ALS II	6156	5493	5690	5918	6218

Next, the number of calls was multiplied by the reimbursement rate, garnered from the U.S. Department of Health and Human Services' Centers for Medicare and Medicaid Services (CMS). The most recent available data (from 2006) was used. All zip codes within Anne Arundel County qualify as "urban" under the CMS classifying system.[39] The reimbursement rates are displayed in Table 85.

Table 85: Reimbursement Rates for EMS Services

Service Type	HCPCS Code	Base Rate & Urban Mileage Reimbursement Rate[40]
BLS Emergency	A0429	$317.23
ALS I Emergency	A0427	$377.23
ALS II Emergency	A0433	$545.99

We calculated the gross potential earnings and reduced the amounts by 50 percent to determine a gross amount (Table 86). The 50 percent reduction was used to estimate a conservative net collection rate of 50%.

Table 86: Potential Net Earnings per Year with Fees EMS Transport

Year	Potential Net Earnings
2003	$6,415,223.75
2004	$6,295,789.67
2005	$6,485,331.42
2006	$6,640,614.91
2007	$6,903,321.95

[39] Ambulance Fee Schedule CY 2006, U.S. Department of Health and Human Services' Centers for Medicare and Medicaid Services' Ambulance Services Center: http://www.cms.hhs.gov/center/ambulance.asp. Accessed: April 25, 2008
[40] Ibid.

Since 2003, the potential earnings have risen. Potential earnings are directly tied to call volume, which has also increased, as seen in Figure 14. With forecast data predicting more calls, the earning potential also rises.

Figure 14: Potential Earnings and Call Volume per Year

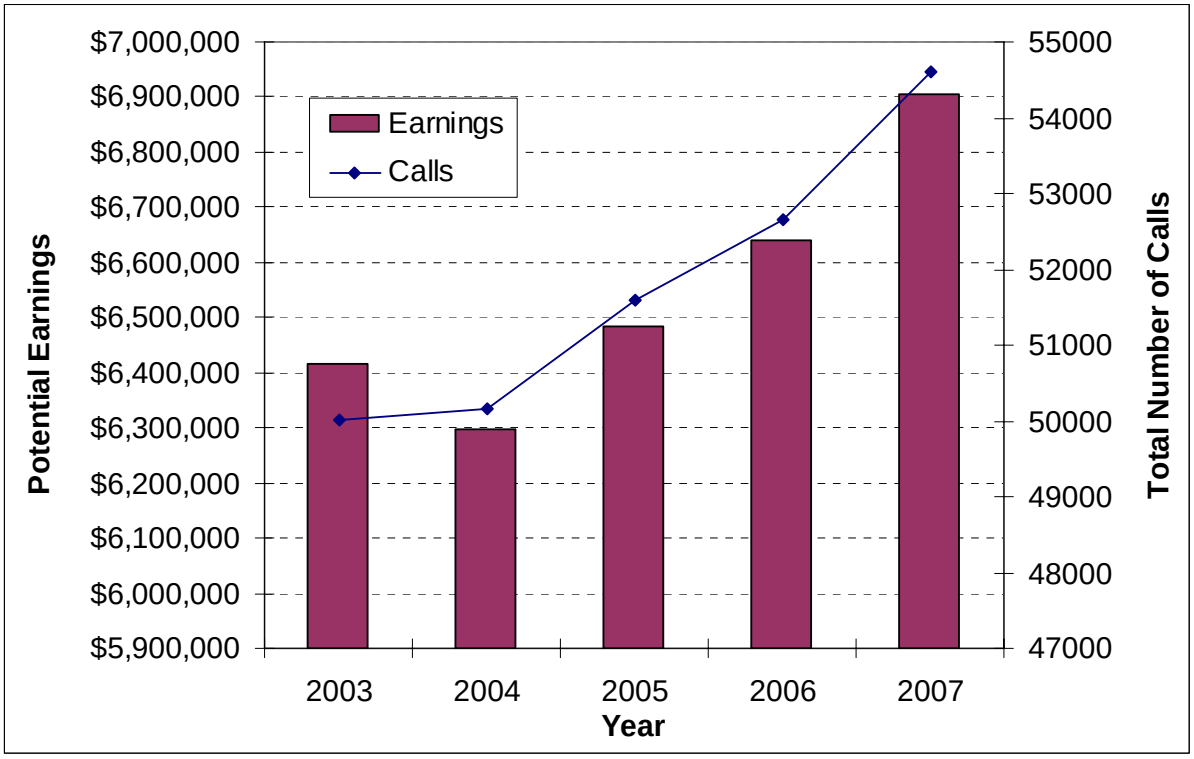
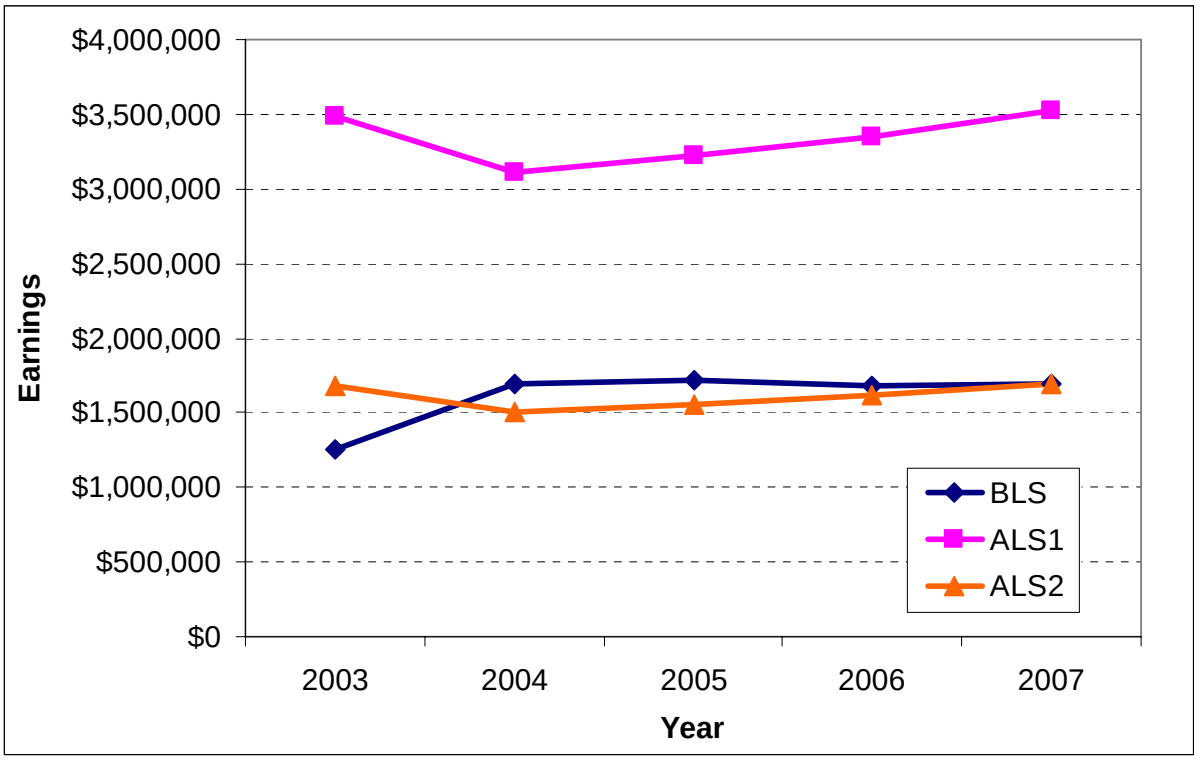


Figure 15 displays the earning potential for each service type (BLS, ALS I, and ALS II), with ALS I calls being the highest. Earnings from ALS II calls have tended to increase as well; however, not at the rate for ALS I calls. Earnings from BLS calls have reached a plateau (as has the call volume) and potential earnings remain steady around $1.69 million dollars.

Figure 15: Potential Earnings per Year by Service Type



How a municipality implements a fee for service plan is a major key to success. Implementation should be deliberate and well-planned, investing time and resources into informing citizens and employees. Misunderstandings can lead to reduced collection and bad publicity.

Collections – The County has taken the appropriate initial steps by seeking legislation and assuring the community that no one will be denied emergency transport based on inability to pay.[41] Collection of co-payments is a sensitive subject that must be carefully decided. In most cases, Medicare will cover 80 percent of the reasonable and customary charges for ambulance service (see above). The remaining 20 percent is collectable from the user. Until 2006, all Medicaid providers had to attempt collection of the co-pay amount. Failure to do so violated federal anti-kickback statutes under which not collecting co-pays is considered as offering discounted service, equivalent to taking a kickback.

[41] Stanek, S. (2008). Council set to approve fees for ambulance rides. *The Baltimore Sun* [On-line version]. www.baltimoresun.com/news/local/annerundel/bal-ar.ambulance28may28,0,7358760

In 2006, the federal Office of the Inspector General issued a limited opinion that absolved governmental-based EMS services from seeking Medicare co-payments provided that the customer was a bona fide resident of the municipality and that part of the service was funded by taxes.[42] The following cautions must be observed:

- The OIG opinion only applies to the requestor. While it appears to absolve the municipality from seeking co-pays from bona fide residents, legal advice should be sought from local counsel.
- The opinion assumes that EMS transportation fees are funded by the municipality. The county should maintain the position that EMS reimbursement only partially offsets the costs of EMS. The remaining costs are bourn by the taxpayer.
- Medicare co-pays should be collected from non-resident visitors.
- A clear understanding on collection of co-pays should exist between the county and any contracted billing agencies.
- Legal counsel should continue to monitor federal court and administrative law decisions concerning anti-kickback statutes.
- By not collecting the Medicare co-pay from county residents, the County will forfeit up to 20% of its expected revenue.

Medicaid (also known as Medical Assistance) is a much smaller percentage of funding. The provider is paid a set rate, with no co-pay involved. CMS requires that all participants in Medicare/Medicaid ambulance reimbursement "accept assignment" for service. This means that, except for Medicare co-pays, the provider cannot *balance bill* for uncovered services. For example, the provider charges $500 and Medicare reimburses $377. Medicare patients can only be billed for 20 percent of $377. The difference between the county's charge and Medicare's reasonable and customary payments ($500 – $377 = $123) must be written off as uncollectible.

Private insurance is handled differently, with each insurance company designating the fee or percentage it will cover and how coverage is authorized. Providers can usually *balance bill* the user for non-reimbursed fees. In a non-competitive situation, the insurance payor may attempt to reach an agreement with the municipality to accept a specific cost per call. An exclusive or high volume insurer may try to work out a capitation fee with the municipality. This is where the insurer pays the municipality a pre-set fee per customer that could cover co-pays or even the

[42] Morris, L. (2006). *OIG Advisory Opinion No. 06-07*. United States Department of Health and Human Services, Office of the Inspector General. June 29, 2006.

entire cost of service. For example, if insurer X is the payer for 30,000 residents and visitors, they may agree to pay the county X amount per patient, per year, i.e. $3.00 times 30,000 customers = $90,000. Any discount or capitation agreement should be discussed with the EMS billing agency.

Billing Agency: The County is seeking an outside billing agency to collect fees for service. This action is appropriate because it places the obligation in the appropriate hands, reduces legal risks and places performance obligations on the outside agency. In these cases, the billing agency usually works on a percentage basis. The agency retains an agreed percentage on the funds collected. They are responsible for collecting co-pays and any balanced billing. The E-PCR system will make operating costs less expensive for the department and the billing agency.

The county should aggressively attempt to find bidders for their contract. Besides the usual sources, advertising should include trade journals and professional association newsletters. A proficient billing agency should be obtainable for a 6–7 percent performance fee.

Public Education: The county is aggressively moving forward on public education. Upon County Council program approval, the AA Co. Fire Department is preparing to provide a *frequently asked questions* section on their website and a toll-free hotline to answer questions. A few things should be emphasized:

- No one will be refused EMS transportation based on inability to pay.
- Fire Department personnel will not collect cash or other payments.
- The Fire Department billing agency will handle all claims paperwork. Reimbursement will come directly to the county.
- The fire chief will designate the officials who can speak for the department on EMS billing. Citizens should be encouraged to call the hotline or send and email.

Follow-up with citizens, healthcare payers and providers will assist in increasing understanding about the program. Consider having the medical director and EMS Division chief meet with the local medical society to explain the program.

EMS Provider Education: Educating providers about the program and their responsibilities is as important as public education. Initially, some of the greatest resistance will be internal. The mainstay of provider education should include:

- Understanding the program goals and objectives
- Knowing how to answer frequently asked questions and where to refer a patient or citizen for more information

- Understanding the importance of properly completed the E-PCR.
- Being able to demonstrate good customer service skills.

When EMS systems become fee-for-service, there is a slight change in expectations. The number of complaints may slightly rise as citizens believe they are now "paying" for EMS. Good customer service skills should balance this phenomenon. Volunteer EMS providers should be included in the education process.

A properly implemented fee-for-service program will allow the county to supplement the tax base for EMS costs. Continuing to stay ahead of the issues should have the department ready to implement the program by April 2009.

VI. FIRE STATION FUNCTIONALITY ASSESSMENT

One purpose of our study was to assess fire station conditions and to recommend necessary actions. Our assessment included an on-site walk-through of each station and a review of the 2006 Entech architectural study findings.

During our visit to each fire station we considered its overall condition and need for repairs or modification. We considered the capacity of the structure to handle existing apparatus and personnel. We considered whether the existing facility could accommodate additional personnel in the future. We also considered the station's location in terms of response time coverage, and whether it paid to repair it if in poor condition vs. building a new station in a better location.

The facility review conducted by TriData is not intended to be a comprehensive facility audit, but rather to assess the county's capital needs in relation to the station locations and overall response times. The county already had a comprehensive audit of the 16 county-owned fire department facilities. The results of that study identified the structural and operational problems in the fire stations. It describes the repairs needed, their costs, and priorities. We reviewed that report and include pertinent information in this chapter.[43] Entech did not assess volunteer-owned stations or the new county-owned stations.

Overall Findings

A review of the current fire department facilities determined the following.

- The newest volunteer station was constructed in 1975 (33 years)
- Two volunteer stations are 78 years old
- Seven of the 11 volunteer-owned facilities are more then 60 years old
- The median age of all stations 36.5 years
- The median age of county-own facilities is 46 years
- Of the 19 county-owned stations, 3 are 60 years or older

Clearly, the fire stations owned and operated by the volunteers are the oldest and need the most attention.

[43] Entech Engineering Inc. (2006). *Facilities Condition Audit for Anne Arundel County, Maryland*. Reading, PA.

At the time of this study, $3M is allocated for all county facility repairs. In addition, $1M is set aside for emergency repairs and those under $25K. There are no funds presently identified for new fire stations except the Marley station (18).

The previously mentioned facilities study completed in January 2006 assessed each fire station. That study "compiled a station repair program scheduled over a 10-year period. The total program is estimated to cost $5.4M, approximately $550K annually. The total cost is to correct existing deficiencies and did not include normal routine operations and maintenance costs. Over 300 separate repair projects were identified. Project costs were ranked by priority: Immediate, High, Medium, and Low. About 12 percent of the project costs were rated as immediate priority." [44] Unlike the comprehensive facilities report that considered the structure and internal systems such as plumbing, heating, and electrical components, the review in this TriData study is the overall adequacy of the facility and its location.

At the time of this writing a new station is under construction in the Annapolis Neck region. Construction costs for the facility are $2.8M with an additional $.5M budgeted for engineering and fees. Typically, the county budgets another $.5M for land acquisition; however, land for this facility is already owned by the county. The typical budget cycle for a new facility is three years:

- Year 1 - Land Acquisition ($.5M)
- Year 2 - Engineering ($.5M)
- Year 3 - Construction ($5.0)[45]

The county has developed a prototype three-bay fire station with drive-through bays. The station is 11,000 square foot, includes brick veneer and is equipped with an automatic sprinkler system. At $2.8M, the cost per square foot for the newest station is $255. The county does not have a prototype design for smaller, less expensive facilities, which the county should consider going forward.

For this project we provided schematics and blueprints for a residential prototype station constructed in Rome/ Floyd County, GA. TriData is familiar with this community from a previous study and found their new stations to be excellent; very function and less expensive. Although land and constructions costs will certainly vary from Rome to Anne Arundel County, it is anticipated the county could probably build the smaller residential-type facilities for $500,000.

[44] Ibid.
[45] The amount funded by the county for construction is $5.M. However, actual construction costs for the Annapolis Neck station was $2.8M.

Land acquisition costs may also be less since the facility is smaller. For the cost analysis portion of this study, the following estimates were used for the residential proto-type station:[46]

- Year 1 - Land Acquisition ($.25M)
- Year 2 - Engineering ($.25)
- Year 3 - Construction ($.5M)

Although the county could save money by constructing residential-type stations similar to those in Rome, GA, fire department officials are concerned that long-term maintenance costs will be higher and negate the initial savings on construction. In the past fire officials recommended that pre-engineered steel facilities could be used; however, Central Service officials did not like the idea, thus standard fire station designs have continued.

Another consideration by the fire department for pre-engineered steel facilities is that they could be disassembled and moved if the station needed to be relocated. This is not a realistic scenario and we are not aware of any community that has moved a pre-engineered facility to another location. For the county going forward, either the modular residential or pre-engineered steel construction could work so long as the building's exterior maintained the character of the surrounding neighborhood. For the present time the most important decision is to agree on the location for new facilities and acquire the land.

Consensus among the facilities staff is that the county needs to pursue a different direction regarding fire station projects. One idea is to request land be set aside by developers during the site-approval; process. The county might also ask developers to include a fire/ EMS facility as part of the new structure. For example, a large retirement-type community could include a small EMS station within the community. In return, EMS personnel could provide increased community risk reduction activities.

There may also be an opportunity for the county to sell some of the existing and poorly located stations and use the proceeds to purchase new property in a better location. Several existing stations recommended for relocation are located on valuable parcels. If sold, the proceeds may cover at least part of the cost for property in the new location. To bridge the multi-year gap between selling an existing station and the construction of a new one, the county should consider a lease arrangement.

Below are the TriData comments on each small planning area's fire stations.

[46] These estimates are based on residential prototype fire station costs in Rome, GA. They should be used only as a starting point for planning purposes.

Annapolis Neck

Annapolis Neck is protected by Station 40. A second, new station (8) is being constructed.

Station 40 is located at 121 Jennifer Road (Annapolis). It is a county-owned facility staffed cooperatively by career and volunteer personnel. A major renovation has been recently completed at this facility, which is capable of accommodating five pieces of apparatus. Apparatus operating out of Station 40 include one engine, one tower, one medic, and pumper/tanker. The height of the apparatus bay doors is barely sufficient for a tower ladder, but is adequate for other apparatus. Aerial apparatus with a lower overall height, including mid-mount tower ladders and trailer-drawn aerials, would be an option in terms of height.

Figure 16: Fire Station 40 – West Annapolis

Living space at this like-new facility is excellent. The bunk room is large, and the locker room is more than adequate. Bathroom facilities include four self-enclosed unisex bathroom and shower facilities located off the locker room. The layout removes the need for dedicated male/female bathroom facilities and allows for very flexible staffing configurations.

The Entech report listed roof damage as a major concern and estimated repair costs at $59,000. Total repair estimate was $305,000.[47]

[47] Ibid., WA p. 1.

Station Condition	Excellent
Long-Term Serviceability	Height of bay doors is a concern and it may limit aerial placement here in the future in the future.[48] There were no other concerns.

Broadneck

Service to the Broadneck area is provided by Stations 17, 19, and 23.

Station 17 is located in Arnold at 1505 Ritchie Highway. This volunteer-owned facility is staffed by five career personnel and supplemented by volunteer firefighters. Living quarters for career personnel are tight but adequate. The volunteer organization has plenty of space for their personnel. The station could easily be modified to increase the accommodations for career personnel. The apparatus bays are old and low, and cannot accommodate an aerial unit. There is not sufficient land around the station to allow for an expansion.

Figure 17: Fire Station 17 – Arnold

While the existing facility is adequate, the Broadneck area would be better served from a fire station near either the intersection of College Parkway and Bay Dale Drive or the area of Jones Station Road and Church Road.

Station Condition	Adequate but not ideal
Long-Term Serviceability	Good location and facilities are adequate for existing needs, but lacks land for expansion

[48] Door height can be a problem for many older stations. For new stations a minimum apparatus door height of 144 inches is recommended.

Station 19 is a County-owned facility associated with the Cape St. Claire VFC. Located at 1411 Cape St. Claire Road in the Annapolis area, this is an older facility that has seen several expansions. The existing structure has five bays, none of which are drive-though or capable of accommodating an aerial device. Currently there are four people staffing this station 24/7. With minimal modifications this facility could accommodate up to six people per shift.

Figure 18: Fire Station 19 – Cape St. Claire

Station Condition	Adequate
Long-Term Serviceability	A good location but undersized living spaces need attention

Entech determined that replacement of the boiler heater and pavement resurfacing were the highest priorities at an estimated cost of $67,000. Total repairs needed were $264,000.[49]

Station 23 is a county-owned facility located at 960 Ritchie Highway. This facility is very similar in layout to Station 21, but has two additional two apparatus bays.

[49] Ibid., Volume 2, p. CSC p. 1.

Figure 19: Fire Station 23 – Jones Station

The station's living quarters are laid out nearly the same as stations 5, 21, and 26, and are more than adequate for the six assigned personnel. This station is in good condition.

Station Condition	Good
Long-Term Serviceability	No Concerns

Entech identified roof replacement and pavement resurfacing as the highest major priorities at an estimated cost of $80,000. Total repairs were estimated at $214,000.[50]

Brooklyn Park

The Brooklyn Park area is served by Station 31. It is a county-owned facility affiliated with the Brooklyn Park Volunteer Fire Company; however, there are no active volunteers at this station. The facility, built in 2003, has three large drive-through bays that house an engine, truck, and medic unit. The living quarters are very nice, with room for more than the existing eight-person staffing. The only issues with this facility are two sporadic roof leaks and maintenance issues with the epoxy floor.

[50] Ibid., Volume 2, JS p. 2.

Figure 20: Fire Station 31 – Brooklyn Park

Station Condition	Excellent
Long-Term Serviceability	Two roof leaks were noted: one in the station's office area and one in a rear stairwell. There are also concerns that the epoxy floor covering on the apparatus floor has not met expectations.

Entech determined that there were no major, immediate repairs needed and total repair costs were estimated at $45,000.

Crofton

The Crofton area is served by Station 5 (Waugh Chapel) and Station 7 (Arundel).

Station 5 is a county-owned facility located at 1300 Waugh Chapel Road (Gambrills). Staffed by five career personnel, one engine and one medic unit operate from this station. The shift commander also operates from Station 5.

Figure 21: Fire Station 5 – Waugh Chapel

While there is plenty of room for apparatus at this facility, living quarters, particularly the bunkroom, are limited. This facility is more than 30 years old and has had no significant upgrade in that time. While it is still in a usable condition, it is in need of modernization and renovation.

Station Condition	Adequate
Long-Term Serviceability	Good location but will need major renovation

Entech determined that the station needs an above ground fuel tank upgrade and a roof replacement estimated to cost $78,000. Total repairs needed are $454,000.[51]

Station 7 is a county-owned facility, with an active volunteer cadre, located at 2380 Davidsonville Road (Gambrills). The station has three drive-through bays to accommodate units.

[51] Ibid., Volume 1, WC pp1-2.

Figure 22: Fire Station 7 – Arundel

Space for the career personnel is limited, and space allocated for volunteers is barely sufficient. The 37-year old station is adequately maintained but significantly undersized. Expansion of staffing at this location would be possible only with a major renovation.

Station Condition	Marginal
Long-Term Serviceability	Good location but will need major renovation

Entech agree with our findings and estimated that $475,000 in repairs were needed.[52]

Crownsville

Service to the Crownsville area is provided primarily from one station.

Station 6 is located in the Herald Harbor community. However, its current location is not good and it does not provide good coverage to the greater Crownsville area because of limited access roads in and out of the area. From its present location, Station 6 has a very long travel distance to major roadways.

Two career personnel are on duty 24/7, and one of these two is an ALS provider. Career personnel operate an engine, medic unit, and tanker supplemented by volunteers. The unit that responds to a call depends on volunteer availability and the needs of the call. The engine often responds with a crew of only two personnel.

[52] Ibid., Volume 1, A pp. 1-2.

This area could be more effectively served by locating a facility near General's Highway and Herald Harbor Road.

Figure 23: Fire Station 6 – Herald Harbor

This station is not in good condition and is barely adequate in terms of size and accommodations. Apparatus bays are completely full and one is partially used as a storage room. Living quarters are very undersized and the volunteers have placed a trailer behind the station for office space. Dormitory facilities for career and volunteer firefighters are also cramped and very outdated.

Station Condition	Poor
Long-Term Serviceability	Size, condition, and location all point to replacement needed in a better location

Entech did not assess this station.

Deale/Shadyside

The Deale/ Shady Side area is protected by three stations (1, 41, and 42).

Station 1 is located at 954 Main Street (Galesville). Volunteer activity at this facility is minimal, and there is a possibility that the volunteer organization may transfer their assets to the County. Station 1 is typical of many volunteer fire stations in older communities where the station is located in the middle of the small community. As the county develops around it however, these stations often are not well located to meet the needs of the larger, surrounding community.

Figure 24: Fire Station 1 – Galesville VFD

Living space is limited, and the station is located at the end of a peninsula. A new facility located one mile south of Galesville Road on Muddy Creek Road appears to be a better location.

Station Condition	Adequate
Long-Term Serviceability	Size, condition, and location all point to need for replacement in a better location

Entech did not assess this station.

Station 41 is a county-owned facility constructed in 1966. Ownership was transferred to the county from the volunteer corporation. The present location, at the end of the peninsula, is not very good. There are three apparatus bays (only two of which are drive through) and they are not able to accommodate large apparatus. A fire/ rescue boat is parked outside on a trailer due to lack of space inside.

Figure 25: Station 41 – Shady Side (Avalon Shores)

Living quarters, too, are small and barely adequate for the five people assigned personnel. Consideration was given to relocating Station 41.

Station Condition	Marginal
Long-Term Serviceability	Size, condition, and location all point to replacement in a better location

Entech determined that the facility immediately needs a boiler, well-water improvements, bay door replacement and façade replacement estimated at $48,000. Total repair needed is $420,000.[53]

Station 42 is located at 6007 Drum Point Road (Deale) and is owned by the Deale VFD. This station has several large apparatus bays, some of which are used for meetings. Most of the bays are shallow, and low clearances are an issue. The living areas are old, small, and cramped. Four career personnel staff the station, responding with the most appropriate apparatus for the call. Equipment includes a pumper/tanker, truck, medic unit, and a host of support and reserve vehicles. At the time of this study, the Deale volunteers had purchased land and were progressing with plans to move the station. We conducted a GIS response time analysis for the new location and found it acceptable.

[53] Ibid., Volume 2, AS pp. 1-2

Figure 26: Station 42 – Deale

Station 42 is often supported by mutual aid from Calvert County, particularly units from North Beach (Station #1) and Dunkirk (Station #5). Though limited in call volume, this station provides coverage for a large portion of the entire South County area.

Station Condition	Marginal
Long-Term Serviceability	Continue with plans to construct a new facility identified by the volunteers

Entech did not assess this station**.**

Edgewater/Mayo

Station 2 is located at 529 Londontown Road in Edgewater. This station has an active volunteer corps that is supplemented by four career personnel working 24/7. As with Station 1, the Woodland Beach VFD is located in an older neighborhood that reduces the utility of the station outside the immediate vicinity. A location closer to the intersection of Route 214 and Muddy Creek Road would allow Company 2's units easy access to the Woodland Beach area while also enhancing utility to the rapid development in this area of the County.

Figure 27: Fire Station 2 – Woodland Beach VFD

Station Condition	Good
Long-Term Serviceability	Consider a location closer to major roads to improve travel times

Entech did not assess this station.

Station 3 is a volunteer-owned facility but totally staffed by career personnel. These personnel provide 24-hour staffing for an engine, medic unit, and a tanker. Station 3 is also the quarters for Battalion 3. The station has seven bays, but none are large enough to house an aerial unit.

Figure 28: Fire Station 3 – Riva VFD

Living quarters are tight, and bathroom facilities are a significant limitation to personnel deployment. Sleeping facilities and locker space are also limited. A major renovation would be necessary in order to increase personnel capacity at Station 3.

Station Condition	Good
Long-Term Serviceability	A good location, but undersized living spaces need attention

Entech did not assess this station.

Glen Burnie

Station 18 is currently located at 100 Summit Avenue in Glen Burnie, but is being replaced with a new facility near the intersection of Baltimore Annapolis Boulevard and Marley Neck Road. The new facility will be approximately one-quarter mile from the existing station, and have better road access.

Figure 29: Fire Station 18 – Marley

The plans for the new station call for an almost identical set-up to that found at Fire Station 4 in Severn. There will be plenty of room for the five personnel assigned as well as the possible addition of others. Department officials expect to occupy the structure by the end of 2009.

Station Condition	Adequate, but being replaced
Long-Term Serviceability	Scheduled for replacement

Station 26 serves the Glen Burnie area from this county-owned facility located at 7880 South Crain Highway. This station is similar in layout to Stations 5, 21, and 23. The station has two drive-through bays that house an engine, tower ladder, and medic unit. Operating three units out of two bays prohibits the engine and/or medic unit from taking full advantage of the drive-through bays.

Figure 30: Fire Station 26 – South Glen Burnie

Living quarters are extremely cramped, as the facility was not designed to accommodate the currently assigned eight personnel per shift. There is no room for exercise equipment and oxygen must be stored in a shed. Expansion of this facility may be possible, as there is county-owned land surrounding the station.

Station Condition	Good but undersized
Long-Term Serviceability	A good location the but undersized living spaces need attention

Entech determined that the toilet and shower renovation is a major issue, estimating the cost at $126,000. Total cost of needed repairs is $322,000.[54]

Station 33 is located at 9 Central Avenue and is a county-owned facility operated in cooperation with the Glen Burnie VFD. There are two separate apparatus bay area. Career personnel operate an engine, truck, medic unit, and EMS supervisor, while volunteers maintain an engine, rescue squad, and ambulance.

[54] Ibid., Volume 2, SGB p. 2.

Figure 31: Fire Station 33 – Glen Burnie

Several bays are too short for aerial apparatus, but the station is capable of supporting a wide variety of apparatus configurations. The volunteer equipment is seldom staffed, but career personnel have access to the rescue squad.

Living quarters are adequate for the nine career people assigned to the station. The EMS officer has their own facility, and the eight others have a livable arrangement. The volunteers maintain a separate bunk facility with a capacity of ten volunteers at nighttime. While the station is not new (1970), it is in good condition.

Station Condition	Good
Long-Term Serviceability	Good location and structure has many useful years remaining

Entech determined that the only immediate major repair needed is repair of the concrete driveway at an estimated cost of $42,000, Total repairs needed is estimated at $510,000.[55]

Jessup-Maryland City

Station 27 is located at 3498 Fort Meade Road. This is a county-owned facility that operates in conjunction with the Maryland City VFD and Rescue Squad. Station 27 has three double-deep bays that are all drive-through. Each is capable of accommodating an aerial device,

[55] Ibid., Volume 2, GB p.2.

if necessary. The station is well-situated near major roadways with easy access to the Baltimore-Washington Parkway and Route 32.

Figure 32: Fire Station 27 – Maryland City

Station 27 is a relatively new facility (1999) with accommodations for many more people than are currently assigned there.

Station Condition	Good
Long-Term Serviceability	No Concerns

Entech determined that no immediate, major problems exist. The total repair cost is estimated at $216,000.

Station 29 serves the Jessup area from a facility on Route 175 just east of the Baltimore-Washington Parkway. As with Station 28, widening of Route 175 may be an issue for the station, though the setback from the roadway is much greater in Jessup than in Odenton. Plans for Route 175 should be monitored to minimize impact on the facility is The facility, built in 1974, has three drive-through bays that house an engine and medic unit. The bays may accommodate a lower-profile aerial apparatus, depending on the exact height of the vehicle.

Figure 33: Fire Station 29 – Jessup

There are two major concerns with this facility. First, the sewer and water systems are in very poor condition and there is need to connect the station to a public water and sewer system. Another concern is the limited living space, which requires a major renovation.

Station Condition	Poor
Long-Term Serviceability	Good location but the structure, water and septic systems are inadequate. The county should connect to the 16" water main available in front of the station on Rt. 175.

Lake Shore

Includes Station 10 (Jacobsville) and Station 20 (Lake Shore).

Station 10 is a County-owned station that is collocated on a very large piece of property with a police facility. Five career personnel staff a pumper/tanker and a medic unit. The station is in average condition.

A better location for Station 10 appears to be on Fort Smallwood Road, but not past Water Oak Point Road

Figure 34: Fire Station 10 – Jacobsville

The layout is very cut-up and limits the number of personnel who can be assigned to Station 10. The police are scheduled to move to a new facility. When this occurs the County could build a new fire station that will meet the needs of the community for decades to come. The current configuration and condition of the facility favor rebuilding over refurbishing.

Station Condition	Adequate
Long-Term Serviceability	Consider rebuilding nearby, but to the northeast

Entech did not assess this station.

Station 20 is a volunteer owned facility at 4498 Mountain Road in Pasadena. This station is staffed with four people who operate an engine and ambulance. There is also a pumper/tanker in the station. The existing facility is in extremely poor condition and is recommended for replacement.

Figure 35: Fire Station 20 – Lake Shore

This facility is small and old and the apparatus bays are barely capable of accommodating modern fire apparatus. A portion of the rear wall was removed so that the existing pumper can fit in the fire station and still allow personnel room to walk past the unit. Living quarters, for both career and volunteer members, are barely adequate for existing staffing levels. There is no way to modify the existing facility to accommodate more personnel. The basement in Station 20 is also untenable with the floors and walls being reinforced by shoring.

By constructing a new facility further east on Mountain Road, improved coverage of Gibson Island can occur while reducing the redundancy of coverage around Stations 10 and 20. Even with Station 20 relocated, four-minute coverage is still provided in this area. A good location for a new Station 20 appears to be on Mountain Road slightly east of Forest Glen Drive.

Station Condition	Poor
Long-Term Serviceability	Marginal location; structure has long outlived its usefulness

Entech did not assess this station.

Linthicum/BWI

Station 32 serves the Linthicum area from their location at 309 S. Camp Meade Road. Built in 1938, the station has seen several upgrades, including an addition and renovations that leave the building in good condition.

Figure 36: Fire Station 32 – Linthicum

In the current configuration there are living quarters for at least nine people per shift, while the station is only staffed with five.

Station Condition	Very good
Long-Term Serviceability	No Concerns

Entech assessed the facility and determined that no immediate, major repairs were needed. Total repairs recommended were estimated at $182,000.[56]

Station 34 is located at 4 Broadview Boulevard (Glen Burnie). Constructed in 1946, the station is owned by the Ferndale VFC. The facility is very small and cramped and the door heights are very low, restricting the height of apparatus that can fit into the station. The station is unable to accommodate aerial equipment.

[56] Ibid., Volume 2, LN, p. 1.

Figure 37: Fire Station 34 – Ferndale

In its current configuration, the career dormitory limits staffing to three people, and the volunteer bunkroom holds a maximum of nine people. Any increasing in staffing at this station would require modifications in the current living arrangements.

At its present location Station 34 is has too much overlap with Station 32, which is 2.5 miles from Station 34 and Station 33, which is 1.7 miles away. There are also railroad tracks immediately in front of Station 34, which sometimes impede apparatus from exiting the station.

A better location for this facility is near the intersection of Ritchie Highway and East Ordinance Road, which is outside of the four-minute response travel time of other stations.

Station Condition	Marginal
Long-Term Serviceability	Size and condition limit functionality, and the location renders the station barely necessary

Entech did not assess this facility.

Odenton

Station 28 is a primarily volunteer-operated facility located on Route 175 near Route 32 in Odenton. The location on Route 175 is good overall; however, plans to widen Route 175 make it likely that Station 28 will have to be relocated. This facility, originally constructed in 1943, is undersized and outdated. The station is also located too close to Route 175, which makes it impossible to pull large apparatus onto the ramp without impeding traffic.

Relocating Station 28 is a moderate priority; however, it will become more pressing as plans to widen Route 175 continue to progress. The station location analysis shows that a new facility should be relocated to the area of Route 175 and Telegraph Road or slightly south on Piney Orchard Parkway.

Figure 38: Fire Station 28 – Odenton

The station's four bays, none of which are drive-through, house a rescue engine, truck, and ambulance as front-line rigs. The engine is staffed with a driver 24/7, and the ambulance has weekday-only daytime staffing with career personnel. The rest of the staffing is handled by a large group of volunteers. Although Station 28 is currently functional considering its current staffing, any increase in personnel will be difficult to accommodate.

Station Condition	Marginal
Long-Term Serviceability	Size, condition, and location all point to replacement in a better location

Entech did not assess this facility.

Pasadena/Marley Neck

Includes Station 11 (Orchard Beach), Station 13 (Rivera Beach), and Station 30 (Arminger).

Station 11 is located at 7549 Solley Road is owned by the Orchard Beach VFD. Located here are one engine, one rescue squad, one ambulance, and one tower ladder.

Figure 39: Fire Station 11 – Orchard Beach

The station is in good condition and has sufficient living space to accommodate staffing for such a large fleet of equipment. The current configuration may need to be modified slightly if more career staff are added, however these modifications would be easy to make.

Station Condition	Good
Long-Term Serviceability	A good location but undersized living spaces need attention

Entech did not assess this station.

Station 13 is owned by the Riviera Beach VFD. Four career personnel cross-staff an engine, a medic, and an ambulance with volunteers supplementing the response.

Figure 40: Fire Station 13 – Riviera Beach

Overall this station is not in very good condition and the interior does not support 24/7 operations. For example, living quarters for the career personnel are cramped and inadequate. The sleeping quarters used by volunteer firefighters are also inadequate. The side bays, from which the volunteers operate is able to accommodate an aerial apparatus; however, the front of the station is unable to house aerial apparatus. Concrete blocks are also located on the bay floor to prevent apparatus from striking the extremely low-hanging ceiling.

Remodeling the interior is possible, but only if the entire structure was to be gutted and a new design implemented. There is sufficient floor space to accommodate adequate living space and necessary apparatus. The Riviera Beach VFD owns the entire corner on which the structure sits, including several private businesses. The land area is more than sufficient for the development of a suitable facility.

Station Condition	Poor
Long-Term Serviceability	Good location but structure needs major renovation

Entech did not assess this station.

Station 30 is located at 304 Mountain Road. Operating from this station is a quint, medic unit, battalion chief, and a daytime EMS officer. It has three drive-through bays. This station also accommodates the department's decontamination unit.

Figure 41: Fire Station 30 – Arminger

Built in 1990, the bays are large enough to accommodate modern apparatus (though a bay door required modification to make this work). Living quarters in the facility are not spacious, but are enough to accommodate the existing crew plus the additional day-shift person.

Station Condition	Good
Long-Term Serviceability	No Concerns

Entech determined that immediate, major repair was needed for the roof and pavement resurfacing; the estimated cost is $60,000, with total recommended repair costs of $120,000.[57]

Severn

The area includes Station 4 (Severn) and Station 21 (Harmans/Dorsey).

Station 4 is a new, county-owned facility located at 7860 Telegraph Road (Severn).

[57] Ibid., Volume 2, AR, pp. 1-2.

Figure 42: Fire Station 4 – Severn

This station has three double-deep drive-through bays that can accommodate any type of apparatus. Living space is also adequate for the five personnel assigned and there is room for additional staffing should it be needed in the future.

Station Condition	Excellent
Long-Term Serviceability	No Concerns

Entech did not assess this station.

Station 21 is a county-owned facility located at 1367 Dorsey Road (Hanover). Built in 1974, Station 21 was renovated in 2000 and is in good condition. There are two drive-through bays housing a medic engine and a medic unit. The placement of aerial apparatus is possible but dependent on the height of the vehicle. There is sufficient land adjacent to the facility for additional apparatus bays.

Figure 43: Fire Station 21 – Harmans/Dorsey

The interior of this station is more than adequate for the five people currently assigned to each shift. With slight alterations additional personnel could be housed here. The station's layout is almost identical to Station 26, which currently houses an engine, tower, and medic unit.

Station Condition	Adequate
Long-Term Serviceability	Good location and condition

Entech assessed the station and recommended immediate, high priority repairs of concrete pavement, security systems, and oil/water separator installation, estimated to cost $63,000. The total recommended repair estimate is $260,000.[58]

Severna Park

The area includes Station 12 (Earleigh Heights).

Station 12 is owned by the Earleigh Heights VFD. Four career personnel and volunteers staff one engine, one rescue squad, and one medic unit.

[58] Ibid., Volume 2, HD, pp. 1-2.

Figure 44: Fire Station 12 – Earleigh Heights

Although somewhat older, Station 12 is in good condition and it can accommodate additional personnel. Door height restrictions do not permit aerial apparatus in the existing structure. The VFD also owns a large, adjacent property, so expansion in the future is possible. The location of Station 12 is excellent.

Station Condition	Good
Long-Term Serviceability	Due to height restrictions, an additional bay would have to be constructed if an aerial apparatus were ever located here

Entech did not assess this station.

South County

This area includes Station 9 (Harwood/Lothian).

Station 9 is a county-owned facility located at 5165 Solomon's Island Road. Six career personnel are on duty here 24/7.

Figure 45: Fire Station 9 – Harwood/Lothian

There are three large drive-through bays at this facility, but low door heights and low ceilings may preclude larger aerial apparatus. Living space in this facility is good, and there is plenty of room for the assigned personnel. More personnel could be accommodated in the future, if necessary.

Station Condition	Good
Long-Term Serviceability	No Concerns

Entech assessment recommended immediate priority to include adding an above ground fuel tank, underground fuel leak detection system, and replacing the roof, estimated to cost $94,000. The complete repair cost estimate is $295,000.[59]

Station Conditions and Ownership

The average age of the 11 volunteer-owned structures is 60 years old. There have been no new volunteer-owned structures built in the county since 1968. County-owned structures have an average age of 33-years old. The average age will drop to 28 years when Stations 8 and 18 are completed. The oldest county-owned structure, Station 32 (Linthicum), is 70-years old; however, this facility is in very good condition.

[59] Ibid., Volume 2, HL, pp. 1-2.

Table 87 depicts the general condition of stations by ownership.

Table 87: Station Conditions by Ownership

Condition	Volunteer-Owned Stations	County-Owned Stations
Poor (0)	3	0
Marginal (1)	3	2
Adequate (2)	2	5
Good (3)	3	7
Very Good (4)	0	1
Excellent (5)	0	3

Table 87 does not include Station 18 (a County-owned facility whose replacement is underway) or Station 8, which is already under construction. These categories, while subjective, still show that there is a significant discrepancy between the conditions of fire stations based on ownership. Using the scale in Table 87, volunteer-owned facilities have an average condition of 1.45 as compared to a mean value of 2.89 for county-owned fire stations. We attempted to determine if building age could be correlated to current conditions. There is no significant correlation between age and the condition of volunteer owned buildings. In contrast, there is a medium to strong, negative correlation between ages of county owned buildings and conditions, a finding that can be expected.

Given this difference in average condition between county and volunteer-owned structures, a reasonable question to ask is, "why?" The two most plausible explanations are maintenance and station design. Maintaining facilities is expensive, and the county-owned stations benefit from an economy of scale in the maintenance of 19 stations that is not found in the 11 independently operated volunteer-owned facilities. Station design is also a likely factor. Many of the volunteer-owned facilities were not built with the idea of full-time staffing in mind. As permanent staffing became necessary, spaces were converted to accommodate personnel. These spaces are often undersized and inadequate. An example of this is the living quarters at Station 20 in Lake Shore. When designed, this facility was never intended to house a minimum of four people 24 hours a day. Likewise, Station 1 in Galesville was not designed with space for personnel in mind. The modification of older structures to accommodate modern staffing needs often results in inadequate facilities.

New Facilities – Construction of new fire and rescue facilities is an expensive undertaking. Anne Arundel County budget documents highlight this point, with $4.8 million being allocated for the replacement of Station 18. The cost per square foot for Station 4 (Severn) was approximately $325, according to county officials.

A consideration to lower the cost of new stations is modular residential (or pre-engineered steel) construction instead of brick and mortar. The modular residential approach has been used successfully inn other communities, including Rome/ Floyd County, GA; Phoenix, AZ; Deerfield Beach, FL, and; Muskegon, MI. In Muskegon, a new stick-built rambler style home was built to house personnel and a large masonry structure was built to house apparatus. The total cost of a facility was $105 per square foot. In Rome/ Floyd County, GA the fire department's prototype design for new stations using residential construction, including quarters for the crew and a garage for the apparatus cost less than $500,000; about 13 percent less than the county budgets for new stations.

There are other benefits to using residential construction techniques. For example, the timeline from breaking ground through opening the facility is greatly reduced. Another benefit is that residential facilities have a slightly lower life expectancy. While a stick-built or modular station can be expected to provide only 30 to 40 years as compared to 50 or more for a traditional facility, this is believed to be an advantage because the needs of the county are continually changing. Because their initial cost is low, the decision can be made whether to rebuild/ remodel the station in the same location, or move it to a better location. A third advantage is that residential stations are designed to blend better with the surrounding community, which helps minimize citizen opposition.

In chapter VII we provide cost estimates for new facilities, including stations recommended for relocation. In most of these, we recommend the less costly residential prototype. Detailed drawings for stations of this type were provided to the county.

VII. SUMMARY OF RECOMMEDATIONS AND THEIR COST

The county desired to understand the estimated cost to implement the major recommendations of this study. It also requested that they be prioritized for planning purposes. The section begins with baseline information on personnel costs by planning area. It then discusses the cost for new facilities and provides a summary of the personnel and station location changes recommended by this study. The chapter concludes with the cost estimate and priority of each recommendation.

Personnel Costs by Rank and Small Planning Area

This study analyzed the demand and response time using the county's 16 small planning areas. To determine how resources were apportioned in relation to these factors, we analyzed the personnel cost by planning area using salary and benefit cost data provided by the fire department.

Personnel – Personnel salaries and benefits are the largest portion of the fire department's annual budget. On average, the county spends approximately $90,000 for each career responder. The cost is even higher when uniforms, training, equipment and other items are factored in.

Table 88 shows the cost by rank for personnel salaries and benefits in FY08. We used these figures to calculate the estimated cost of personnel to implement the various recommendations.

Table 88: AACoFD Personnel Cost by Rank/ FY08

Rank	Salary	Pension	Insurance	FICA	Total Salary & Benefits
Captain	$89,467	$21,740	$7,500	$6,844	$125,552
Lieutenant	$75,640	$18,381	$7,500	$5,786	$107,307
Firefighter V (EMT-P)	$55,458	$13,476	$7,500	$4,243	$80,677
Firefighter IV (EMT-I)	$44,959	$10,925	$7,500	$3,439	$66,823
Firefighter III (PO)	$62,615	$15,215	$7,500	$4,790	$90,120
Firefighter II	$46,120	$11,207	$7,500	$3,528	$68,355
Average	**$62,377**	**$15,157**	**$7,500**	**$4,772**	**$89,806**

To provide services around the clock requires the fire department to have slightly more than five FTE personnel (5.12) on the payroll, according to the fire department's most recent staffing factor analysis. To add one firefighter position to an existing or new unit requires adding one firefighter to each of the four shifts plus one additional firefighter to cover anticipated and

unanticipated absences such as vacation or sick leave. To add one paramedic for example, would cost the county $413,000 (5.12 x $80,677), not including equipment or other costs such as training. Averaged for all ranks, benefit costs are 31 percent of the total cost for each responder ($27,429/$89,806).[60]

Cost by Planning Area – To analyze the costs for services by planning area, we considered the primary stations within each planning area and the stations contiguous to that particular area. The purpose was to gain understanding of where resources are deployed respective to the current and expected demand and risk. From the analysis it was learned that several stations are strategically located such that they multiple planning areas, thus improve efficiency. Station 3 (Riva) is one such station.

Table 89 shows the fire and EMS service to each planning area. The complete set of worksheets for the analysis can be found in the Appendix.

Table 89: High to Low Personnel Cost by Planning Area/ FY08

Planning Area	Population	Cost for Service	Cost per Capita	Percent of Demand 2003-2007
Deale/ Shady Side	11,116	$4,834,924	$435	4%
Brooklyn Park	13,642	$3,985,815	$292	5%
Linthicum/ BWI	17,072	$4,914,536	$288	8%
Annapolis Neck	22,609	$5,017,917	$222	7%
Crownsville	15,438	$3,137,025	$203	1%
Edgewater/ Mayo	16,884	$3,187,926	$189	7%
Lake Shore	26,073	$4,243,671	$163	5%
Pasadena/ Marley Neck	33,239	$5,372,812	$162	9%
Jessup/ Maryland City	20,522	$3,227,361	$157	5%
South County	17,267	$2,440,024	$141	2%
Broadneck	38,250	$5,047,577	$132	8%
Crofton	27,243	$2,894,850	$106	7%
Severn	36,896	$3,765,725	$102	5%
Severna Park	35,367	$3,327,546	$94	5%
Glen Burnie	73,951	$5,543,001	$75	19%
Odenton	37,916	$2,278,259	$60	5%

Note: Personnel costs include salaries and benefits only; overtime is not included.

[60] Based on a recent SAFER grant application prepared by the fire department, it believes the percentage is actually higher (near 50 percent).

The density of population in Glen Burnie improves efficiency per capita—there is an economy of scale, and thus the lower cost per capita than Deale/ Shady Side, which has the smallest population of the 16 planning areas. Odenton has the lowest cost per capita, a product of the very active cadre of volunteers there, who provide the majority of service. These results both underscore the desirability of keeping the volunteer system strong, and also the impact of land use planning that concentrates populations to reduce service costs.

New Facility Costs

Our station location and facilities review recommends 11 new stations; of which10 are changes in the location of existing facilities. Only one additional station is recommended, for South County.

Recurring salaries and benefits for personnel is the highest cost factor to consider when adding new services. One-time capital expenditures, though much lower than personnel costs are also important considerations. However, properly constructed and maintained fire stations can provide 50 years or more of useable life. The cost to construct new stations and maintain them is much lower than for the personnel that staff them.

The county presently funds new fire stations over a three-year period. The first two years include land acquisition ($250k) and architectural/ engineering costs ($250k). Funds for actual construction are provided in the third year. Funding for new stations are presently estimated at $4.0M each, although the most recent station (8 - Annapolis Neck) was constructed for considerably less ($2.8M).

The newest facility (Station 8) is being constructed on 2.2 acres of land already owned by the county. A three-bay drive-through 'brick and mortar' facility, the facility is 11,000 square feet with a cost per square foot of $245. The model for Station 8 is typical of most fire stations built today. In light of the number of new facilities which are needed to replace the aging inventory of county stations; however, the county should consider less expensive options, including smaller residential-style facilities.

For this project we provided schematics and drawings of a smaller, residential-style station currently used in Rome/ Floyd County, GA.[61] New stations constructed in this community are modular, so they are cheaper to construct and they require less land. Savings are also possible on engineering and architectural fees. We estimated that such facilities could be constructed at approximately one-fourth the cost of the traditional station. For this project we

[61] We want to thank Rome/ Floyd County for graciously providing copies of the drawings and schematics to Anne Arundel County based on our request.

applied the county's three-year funding schedule and estimated the cost for nine of the new stations as follows:

- Year 1 - Land Acquisition ($.25M)
- Year 2 - Engineering ($.25M)
- Year 3 - Construction ($.5M)

For the remaining two stations, Odenton (28) and South Glen Burnie (26) however, we used the county's current funding formula. We did this because Odenton is the most active volunteer station and the county should want to encourage a continuance of the all-volunteer company, thus a larger facility will probably be necessary. In the case of Station 26, the station is projected to remain a full service facility housing an engine, truck and medic, thus more space would likely be required. For all other facilities we priced them using the residential model. We did not factor in the cost of inflation for out years.

Summary of Station Location and Staffing Recommendations

In this section we give our suggested priorities for the station location and staffing changes recommended earlier. In each case we considered the adequacy of the current location and level of service. We developed the priorities based on the data analysis of response times, and the current and anticipated demand for services. We formed a consensus opinion among the project team based on this information. We also discussed the changes (and priorities) with fire department management, but these suggested priorities are those of the TriData project team.

In some cases the priority established by the project team may be different from those of county planners and elected officials, fire department management, or both. We recommend a more detailed review of each recommendation and its priority before adopting them as part of the county's general plan.

Highest Priority

Facilities -

- Relocate Station 1 (Deal/ Shady Side) near Galesville Road and Muddy Creek Road
- Relocate Station 20 Lake Shore) near Forrest Glen Drive and Mountain Road

Personnel -

- Add personnel to staff the medic units at Stations 1, 2, 6, 10, 11, 19, and 42 independently of the engines

- Add an officer at Station 12 to staff the medic unit independently of the engine
- Add personnel to Station 20 and upgrade the BLS unit to paramedic
- Add a medic unit to Station 23
- Add a paramedic (4th person) to Quint 23
- Add personnel to Station 27 to upgrade the engine to four-person paramedic engine; maintain the current medic unit
- Add a medic unit to Station 28; maintain the current volunteer BLS unit
- Upgrade the BLS unit at Station 41 to an independently staffed medic

High Priority

Facilities -

- Relocate Station 6 (Crownsville) near Generals Highway and Herald Harbor Road
- Relocate Station 2 (Edgewater/ Mayo) near Route 214 and Muddy Creek Road

Personnel -

- Add weekday BLS units to existing stations 18, 21, and 31
- Eliminate the cross-staffed fire/ BLS crew at Station 34 and assign a medic crew[62]
- Upgrade the engine at Station 31 to paramedic; no additional personnel
- Add staffing to the quint at Station 4 to provide a four-person unit, including a paramedic
- Add an officer to Station 7 and upgrade the engine to paramedic
- Upgrade the engine at Station 12 to a paramedic
- Increase staffing on the truck at Station 21 (relocated from S-33) to four, including an officer

[62] The medic crew could also be assigned to Station 33 as a second unit. In this case, Station 34 would remain a volunteer-only station.

- Add one officer to the truck at Station 26 and increase staffing from three to four
- Add one officer to the truck at Station 40 and increase staffing from three to four
- Upgrade the engine at Station 41 to a four-person paramedic engine

Moderate Priority

Facilities -

- Construct a new station near the intersection of Davidsonville Road and Central Avenue in South County
- Relocate Station 28 (Odenton) near Route 175 and Telegraph Road or slightly south on Piney Orchard Parkway
- Relocate Truck 33 (Glen Burnie) to Station 21 (Severn)

Personnel -

- Increase the staffing on the engine at Station 1 from three to four
- Change the engine to a quint at Station 5 and upgrade to a four-person paramedic unit
- Add one officer at Station 13 and staff the medic unit independently of the engine
- Increase the staffing on the quint at Station 30 to four
- Add an officer to the truck at Station 31 and increase staffing to four
- Upgrade the engines at Stations 21 and 42 to paramedic engine

Lower Priority

Facilities -

- Relocate Station 17 (Broadneck) near Jones Station Road and Church Road
- Relocate Station 26 (Glen Burnie) near Veterans Highway and Old Mill Road.

- Rebuild Station 29 (Jessup/ Maryland City) on or near its present site (additional water and sewer problems with the facility or changes to Route 175 could change the priority)
- Rebuild Station 10 (Lake Shore) on its present site or slightly northeast near Water Oak Point Road and Fort Smallwood Road
- Relocate Station 34 (BWI/ Linthicum) to Glen Burnie near Ritchie Highway and East Ordnance Road

Personnel -

- Add weekday BLS units at Stations 3, 5, 23, and 40 (monitor the impact of S-8 before deciding on a BLS units at Station 40)
- Add a medic unit to the new Glen Burnie station when it is built
- Upgrade the pumper/tanker at Station 6 to a paramedic unit with a four-person crew
- Upgrade the pumper/ tanker at Station 9 to paramedic and increase staffing to four-persons
- Upgrade the pumper/ tanker at Station 17 to paramedic; no additional personnel are required
- Increase staffing on the special operations unit at Station 23 from three to four, including an officer

To deliver services more effectively and meet future demand, particularly for EMS, staffing needs outweigh that of adding more stations. Previous studies have recommended many new stations as the way to address the response time and delivery issue. The results of this study did not reach the same conclusion.

TriData's analysis determined that cross-staffing, not facility locations, is having the most negative impact on response times. Many of the county's existing facilities are also older and many are not in the best location, so it is important to address them. However, adding stations or building new ones at existing locations will not solve the issue of response time and service delivery without addressing the staffing situation.

Expensive as it may be, the county should begin to reduce the number of cross-staffed units by increasing the staffing at the most critical locations. If it does not, it can expect response times to continue increasing with the projected increases in EMS demand. This study does that

by addressing the staffing issue where cross-staffed EMS units are located. In fact, the first eight recommendations relative to personnel address staffing to improve EMS.

Table 90 shows the proposed staffing, equipment and level of EMS service provided from each station and the priority for any changes. We also summarized the activity level of volunteers, if any, at the particular station.

If the entire slate of station and apparatus changes were implemented the county would operate from 33 stations instead of the present 31 (which includes new Station 8). The two additional stations would be one in north Glen Burnie and one in South County. The new Glen Burnie station will actually be a replacement for Station 34, which is currently a volunteer-owned facility. Paramedic engines to improve ALS delivery are proposed for 16 stations in addition to the 31 independently staffed medic units.

Table 90: Proposed Deployment - Apparatus and Staffing by Station

Station/ *Planning Area*	Proposed Units	Other Services	Level of EMS	Volunteer Participation	Proposed Minimum Career Staffing[63]	Change	Priority
1 – Galesville *Deale/ Shady Side*	1 Engine 1 Tanker 1 Medic	1 Brush	ALS	No Volunteers	Engine 1 - Officer 1 - FF 3 2 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Engine staffing increased from 3 to 4. Medic unit staffed independently 24/7.	Moderate Very High
2 – Woodland Beach *Edgewater/ Mayo*	1 PM Engine 1 Engine (V) 1 Medic 1 BLS (V)	1 Squad	ALS and BLS	Very Good	PM Engine 1 - Officer 1 - FF 3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6 Volunteers to staff the BLS unit.	Medic unit staffed independently 24/7	Very High

[63] Minimum staffing does not include battalion chiefs or EMS officers.

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
3 – Riva *Edgewater/ Mayo*	1 PM Engine 1 Tanker (V) 1 Medic 1 BLS (M/F)	1 Brush	ALS and BLS (M/F)	No Volunteers	PM Engine 1 - Officer 1 - FF3 1 - FF2 Tanker 1 - FF3 Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T = 8/6	Add staffed BLS unit (M/F).	Low
4 – Severn *Severn*	1 PM Quint 1 Medic	1 Mass Casualty Unit	ALS	No Volunteers	Quint 1 - Officer 1 - FF3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Quint upgraded to paramedic and four-person crew.	High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
5 – Waugh Chapel *Crofton*	1 Quint 1 Medic 1 BLS (M/F)		ALS and BLS (M/F)	No Volunteers	Quint 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T = 8/6	Change from engine to quint and upgrade to a four-person crew. Add staffed BLS unit (M/F).	Moderate Low
6 – Herald Harbor *Crownsville*	1 PM Pumper/ Tanker 1 Medic	1 Brush	ALS	Very Low	PM Pumper/ Tanker 1 - Officer 1 - FF3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Upgrade to pumper/tanker to paramedic with four-person crew. Medic unit staffed independently.	Low Very High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
7 – Arundel *Crofton*	1 PM Engine 1 Engine (V) 1 BLS (V)	1 Squad	ALS and BLS	Very Good	PM Engine 1 - Officer 1 - FF3 1 - FF/PM T = 3	Upgrade engine to three-person paramedic engine. Note: Volunteers staff squad, BLS unit and second engine.	High
8 – Annapolis Neck *Annapolis Neck*	1 PM Engine 1 Medic		ALS	No Volunteers	PM Engine 1 - Officer 1 - FF3 1 - FF/PM Medic 1 - FF/PM 1 - FF2 T = 5	New Service	N/A
9 – Harwood/ Lothian *South County*	1 PM Pumper/ Tanker 1 Medic	1 Brush	ALS	No Volunteers	PM Pumper/ Tanker 1 - Officer 1 - FF3 1 - FF/ PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Upgrade to paramedic pumper/ tanker with four-person crew.	Low

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
10 – Jacobsville *Lake Shore*	1 Pumper/ Tanker 1 Medic		ALS	No Volunteers	Pumper/ Tanker 1 - 0fficer 1 - FF3 1 - FF/PM Medic 1 - FF/PM 1 - FF2 T = 5	Add one person to staff medic unit independently.	Very High
11 – Orchard Beach *Pasadena/ Marley Neck*	1 Engine (V) 1 Truck/ Tower (V) 1 Medic	1 Brush 1 ROC 1 Special Unit 1 Squad	ALS	Low	Engine or Truck 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5 Career personnel respond first out with engine or truck; volunteers staff the remaining unit/s	Upgrade medic to independently staffed unit.	Very High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
12 – Earleigh Heights *Severna Park*	1 PM Engine 1 Engine (V) 1 Medic	1 Brush 1 Squad	ALS	Good	PM Engine 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5	Upgrade engine to paramedic. Add one officer to allow engine and medic to be staffed independently.	High Very High
13 – Rivera Beach *Pasadena/ Marley Neck*	1 Engine (V) 1 Pumper/ Tanker (V) 1 Quint (V) 1 Medic	1 Brush 1 Fire Boat 1 Squad	ALS	Excellent	Engine 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5	Add one officer to allow engine and medic to be staffed independently.	Moderate

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
17 – Arnold *Broadneck*	1 PM Engine 1 Engine (V) 1 Medic	1 Brush	ALS	Very Low	PM Engine 1 - Officer 1 - FF3 1 - FF/PM Medic 1 - FF/PM 1 - FF2 T = 5	Upgrade to paramedic engine; no additional personnel required.	Low
18 – Marley *Glen Burnie*	1 Engine 1 Medic 1 BLS (M/F)	1 Brush	ALS and BLS (M/F)	No Volunteers	Engine 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T = 7/5	Add staffed BLS unit (M/F).	High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
19 – Cape St. Clare *Broadneck*	1 Engine 1 Engine (V) 1 Medic	1 Brush	ALS	Very Low	Engine 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5	Upgrade medic to independently staffed unit.	Very High
20 – Lake Shore *Lake Shore*	1 Engine 1 Pumper/ Tanker (V) 1 Medic	1 Brush 1 Fire Boat	ALS	Low	Engine 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Add staffed medic unit.	Very High
21 – Harmons Dorsey *Severn*	1 PM Engine 1 Truck/ Tower 1 Medic 1 BLS (M/F)		ALS and BLS (M/F)	No Volunteers	Engine 1 - Officer 1 - FF3 1 - FF/PM Truck/ Tower 1 - Officer 1 - FF3 2 - FF2	Upgrade engine to paramedic engine Relocate truck from S-33 and add officer for truck. Upgrade truck to four-personnel, including	Moderate Moderate High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
						an officer. Add BLS unit (M/F).	 High
					Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T = 11/9		
23 – Jones Station *Broadneck*	1 PM Quint 1 Special Operations 1 Medic 1 BLS (M/F)		ALS and BLS (M/F)	No Volunteers	PM Quint 1 - Officer 1 - FF3 1 - FF/PM 1 - Ff2 Rescue 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T =12/10	Upgrade quint to four-person crew with paramedic. Add staffed BLS unit (M/F). Add Medic unit. Increase staffing from three to four on the special operations unit, including an officer.	Very High Low Very High Low

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
26 – South Glen Burnie *Glen Burnie*	1 PM Engine 1 Truck/ Tower 1 Medic		ALS	No Volunteers	PM Engine 1 - Officer 1 - FF3 1 - FF/PM Truck/ Tower 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 T = 9	Add officer and increase truck crew from three to four.	High
27 – Maryland City *Jessup-Maryland City*	1 PM Engine 1 Engine (V) 1 Medic	1 Brush	ALS	Very Low	PM Engine 1 - Officer 1 - FF3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6 When available,	Upgrade the engine to a four-person paramedic.	Very High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
					volunteers augment service with second engine.		
28 – Odenton *Odenton*	2 Engines (V) 1 Medic 1 BLS (V)		ALS and BLS	Excellent	Engine 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 4 As available, volunteers staff BLS unit	Add medic unit 24/7.	Very High
29 – Jessup *Jessup-Maryland City*	1 Pumper/ Tanker 1 Medic	1 Brush	ALS	Poor	Pumper/ Tanker 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5	No change.	
30 – Arminger *Pasadena/ Marley Neck*	1 Quint 1 Medic	1 Decon	ALS	No Volunteers	Quint 1 - Officer 1 - FF3 2 - FF2	Quint staffing increased from three to four.	Moderate

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
					Medic 1 - FF/PM 1 - FF2 T = 6		
31 – Brooklyn *Brooklyn Park*	1 PM Engine 1 Truck/Tower 1 Medic 1 BLS (M/F)		ALS and BLS (M/F)	No Volunteers	Engine 1 - Officer 1 - FF3 1 - FF/PM Truck/ Tower 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 BLS 2 EMTs (M/F) T = 11/9	Upgrade the engine to paramedic Add an officer to the truck and increase staffing from three to four. Add staffed BLS unit (M/F).	High Moderate High
32 – Linthicum *BWI/Linthicum*	1 Engine 1 Medic	1 ROC	ALS	No Volunteers	Engine 1 - Officer 1 - FF3 1 - FF2	No changes	

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
					Medic 1 - FF/PM 1 - FF2 T = 5		
33 – Glen Burnie *Glen Burnie*	1 Engine 1 Engine (V) 1 Medic	1 Squad	ALS	Poor	Engine 1 - Officer 1 - FF3 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 5	Relocate truck to Station 21.	Moderate
34 – Ferndale *BWI/ Linthicum*	1 Engine (V) 1 Medic	1 Squad (V)	ALS	Very Low	Medic 1 - FF/PM 1 - FF2 T = 2 Volunteer engine/ squad remains but without cross-staffing by career personnel.	Eliminate the cross-staffed fire/ BLS crew and replace with a medic unit.	High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
40 – West Annapolis *Annapolis Neck*	1 Engine 1 Truck/ Tower 1 Engine (V) 1 Tanker (V) 1 Medic 1 BLS (M/F)	1 Brush	ALS and BLS (M/F)	Fair	Engine 1 - Officer 1 - FF3 1 - FF2 Truck/ Tower 1 - Officer 1 - FF3 2 - FF2 Medic 1 - FF/PM 1 - FF2 BLS 2 - EMTs (M/F) T = 11/9	Add officer to the truck and increase from three to four-person crew. Add staffed BLS unit (M/F).	High Low (Monitor S-8's impact then decide)
41 – Shady Side *Deale/ Shady Side*	1 PM Engine 1 Medic	1 Brush	ALS	No Volunteers	PM Engine 1 - Officer 1 - FF3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Upgrade engine to four-person paramedic. Upgrade BLS to independently staffed medic.	High Very High

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
42 – Deale *Deale/ Shady Side*	1 PM Engine 1 Pumper/Tanker (V) 1 Truck/ Tower (V) 1 Medic	1 Brush 2 Fireboats	ALS	Fair	PM Engine 1 - Officer 1 - FF3 1 - FF/PM 1 - FF2 Medic 1 - FF/PM 1 - FF2 T = 6	Upgrade engine to paramedic. Independently staff the medic unit.	Moderate Very High
New Station *South County*	1 PM Quint 1 Medic		ALS	No Volunteers	PM Quint 1 - Officer 1 - FF3 1 - FF/.PM 1 - FF/2 Medic 1 - FF/PM 1 - FfF2 T = 6	New Service	Moderate
New Station *Glen Burnie*	1 PM Engine 1 Medic		ALS	No Volunteers	Engine 1 - Officer 1 - FF3 1 - FF/PM Medic	Replaces Station 34 Medic crew already in place with elimination	Low N/A

Station/ *Planning Area*	**Proposed Units**	**Other Services**	**Level of EMS**	**Volunteer Participation**	**Proposed Minimum Career Staffing[63]**	**Change**	**Priority**
Note: This station would replace S-34 (Ferndale) in the BWI/Linthicum planning area.					1 - FF/PM 1 - FfF2 T = 5	of cross-staffed crew at Station 34.	
Totals 33 Stations	9 - Engines 13 - Engines (V) 11 - PM Engines 2 - PM Pumper/ Tankers 2 - Pumper/ Tankers 3 - Pumper/ Tankers (V) 3 - PM Quints 2 - Quints 1 - Quints (V) 4 - Trucks/ Towers 2 - Trucks/ Towers (V) 1 - Tanker 2 - Tankers (V) 31 - Medics 3 - BLS (V) 7 - BLS (M/F) 1 - Special Operations	8 - Squads 16 – Brush 1 – Special Unit 1 – Mass-Casualty Unit 2 – ROC 6 – Fireboats 1 – Decon			Daily staffing requirements include: 36 Officers 38 FF3's 47 FF/Pam's 70 FF2's 191 FTE Positions Weekday (40-hour) positions include: 14 EMTs Total = 205		

Engines and pumper/tankers, which are the primary suppression units used by the fire department, decrease from 42 to 40 while the number of towers/ ladders or quints increase from 10 to 12 under the plan. Most importantly, ALS services will be provided by 47 units under the proposed plan, as compared to the current 19 units.[64]

Under the plan, BLS units are assigned to stations, primarily for administrative purposes. However, the county should consider these to be dynamic assets and move them to areas of greatest need. For example, BLS units could handle routine, non-emergency calls and they could be strategically located at high-volume call points such as long-term care facilities. BLS units could also be assigned during the shift to handle patient transfers from ALS units at area hospitals, which is a problem now.

Cost of Recommended Changes

To determine the number of positions and cost of the proposed additional staffing, we used the department's staffing factor and calculated the positions necessary for each change. To cost new officer positions, we calculated the cost of Firefighter II plus the difference between Firefighter V (FF/PM) and lieutenant.

The fire department's policy is to sometimes assign personnel with ranks other than paramedic to achieve the necessary ALS coverage. For example, officers or pump operators (driver) with EMT-P certifications are sometimes used to improve the level of medical care in a particular area. For this reason it is not possible to be exact in estimating the cost; however, it is close enough for initial planning purposes. Likewise, the number of positions needed, by rank, may also not be exact - for the same reason.

Presently the fire department assigns two paramedics to most medic units. Under the deployment plan proposed by TriData, advanced life support (ALS) units would be staffed by one paramedic and one EMT-B. In these stations one paramedic would be assigned to the engine and one to the ALS unit. Paramedics would be rotated between the ALS units and engine to maintain their skill proficiency in both areas.

Table 91 shows the priority, additional staffing requirements, capital projects, and estimated cost to implement the recommendations of this study.

[64] This includes 41 medic units and 16 paramedic engines, quints, or pumper tankers.

Table 91: AACoFD Deployment Recommendations/ Estimated Cost and Priority

Very High Priority Recommendations	Additional Staff Requirements	Annual Cost	Capital Facility Cost/ $000			
			Year 1	Year 2	Year 3	Total
Construct a new station near Galesville Road and Muddy Creek Road			$250	$250	$500	$1,000
Construct a new station near Forrest Glen Drive and Mountain Road			$250	$250	$500	$1,000
Add personnel to staff the medic units at Stations 1, 2, 6, 10, 11, 19, and 42 independently of the engines	46 Firefighters	$3,144,330				
Add an officer at Station 12 to staff the medic unit independently of the engine	4 Lieutenants	$418,726				
Add personnel to Station 20 and upgrade the BLS unit to paramedic	10 Firefighters	$683,550				
Add a medic unit to Station 23	10 Firefighters	$683,550				
Add a paramedic (4th person) to Quint 23	5 Firefighters	$341,775				
Add personnel to Station 27 to upgrade the engine to four-person paramedic engine; maintain the current medic unit	20 Firefighters + officer $$ difference	$1,418,661				
Add a medic unit to Station 28; maintain the current volunteer BLS unit	10 Firefighters	$683,550				
Upgrade the BLS unit at Station 41 to an independently staffed medic	5 Firefighters	$341,775				
Total	**110 FTE**	**$7,715,917**	**$2,000,000**			

High Priority Recommendations	Additional Staff Requirements	Annual Cost	Capital Facility Cost/ $000			
			Year 1	Year 2	Year 3	Total
Construct a new station near Generals Highway and Herald Harbor Road			$250	$250	$500	$1,000
Construct a new station near Route 214 and Muddy Creek Road			$250	$250	$500	$1,000
Add three weekday BLS units to stations 18, 21, and 31	8 EMTs	$392,386[65]				
Eliminate the cross-staffed fire/ BLS crew at Station 34 and assign a medic crew	No additional personnel	$0				
Upgrade the engine at Station 31 to paramedic	No additional personnel	$0				
Add staffing to the quint at Station 4 to provide a four-person unit, including a paramedic	5 Firefighters	$341,775				
Add an officer to Station 7 and upgrade the engine to paramedic	5 Firefighters + officer $$ difference	$411,581				
Upgrade the engine at Station 12 to a paramedic engine	No additional personnel	$0				
Increase staffing on the truck at Station 21 (relocated from S-33) to four, including an officer	5 Firefighters + officer $$ difference	$411,581				
Increase staffing on the truck at Station 26 to four, including an officer	5 Firefighters + officer $$ difference	$411,581				
Increase staffing on the truck at Station 40 to four, including an officer	5 Firefighters + officer $$ difference	$411,581				
Upgrade the engine at Station 41 to a four-person paramedic engine	10 Firefighters	$683,550				
Total	**43 FTE**	**$3,064,035**	**$2,000,000**			

[65] To estimate the annual salary for EMT, we used $30,000 as the entry-level salary and added the percentage of benefits for EMT-I. EMT salary comparisons (and jobs can be found at http://www.indeed.com/salary?q1=EMT&l1=Maryland. We considered the positions 40-hour employees with two positions to cover absences.

Moderate Priority Recommendations	Additional Staff Requirements	Annual Cost	Capital Facility Cost/ $000			
			Year 1	Year 2	Year 3	Total
Construct a new station near the intersection of Davidsonville Road and Central Avenue in South County			$250	$250	$500	$1,000
Construct a new station near Route 175 and Telegraph Road or slightly south on Piney Orchard Parkway			$500	$500	$2,800	$3,800
Relocate Truck 33 from Glen Burnie to Station 21			$10	$10		
Increase the staffing on the engine at Station 1 to four, including an officer	5 Firefighters + officer $$ difference	$411,581				
Change the engine to a paramedic quint at Station 5 and increase staffing to four	5 Firefighters	$341,775				
Add one officer at Station 13 and staff the medic unit independently of the engine	5 Firefighters + officer $$ difference	$411,581				
Increase the staffing on the quint at Station 30 to four	5 Firefighters	$341,775				
Add an officer to the truck at Station 31 and increase staffing to four	5 Firefighters + officer $$ difference	$411,581				
Upgrade the engines at Stations 21 and 42 to paramedic	No additional personnel	$0				
Total	**25 FTE**	**$1,918,293**	**$4,800,010**			

Low Priority Recommendations	Additional Staff Requirements	Annual Cost	Capital Facility Cost/ $000			
			Year 1	Year 2	Year 3	Total
Construct a new station near Jones Station Road and Church Road			$250	$250	$500	$1,000
Construct a new station to replace Station 26 near Veterans Highway and Old Mill Road.			$500	$500	$2,800	$3,800
Construct a new station on or near Station 29's present location			$250	$250	$500	$1,000
Construct a new station to replace Station 10 on its present site or slightly northeast near Water Oak Point Road and Fort Smallwood Road			$250	$250	$500	$1,000
Construct a new station to replace Station 34 near Ritchie Highway and East Ordnance Road			$250	$250	$500	$1,000
Add weekday BLS units at Stations 3, 5, 23, and 40 (monitor the impact of S-8 before deciding on a BLS units at Station 40)	10 EMTs	$490,483				
Add a medic unit to the new Glen Burnie station when it is built	10 Firefighters	$683,550				
Upgrade the pumper/tanker at Station 6 to a four-person crew with paramedic	10 Firefighters + officer $$ difference	$753,356				
Upgrade the pumper/ tanker at Station 9 to a four-person crew with paramedic	5 Firefighters	$341,775				
Upgrade the pumper/ tanker at Station 17 to paramedic	No additional personnel	$0				
Total	**35 FTE**	**$2,269,164**	**$7,800,000**			
Grand Total	**213 FTE**	**$14,967,409**	**$16,600,000**			

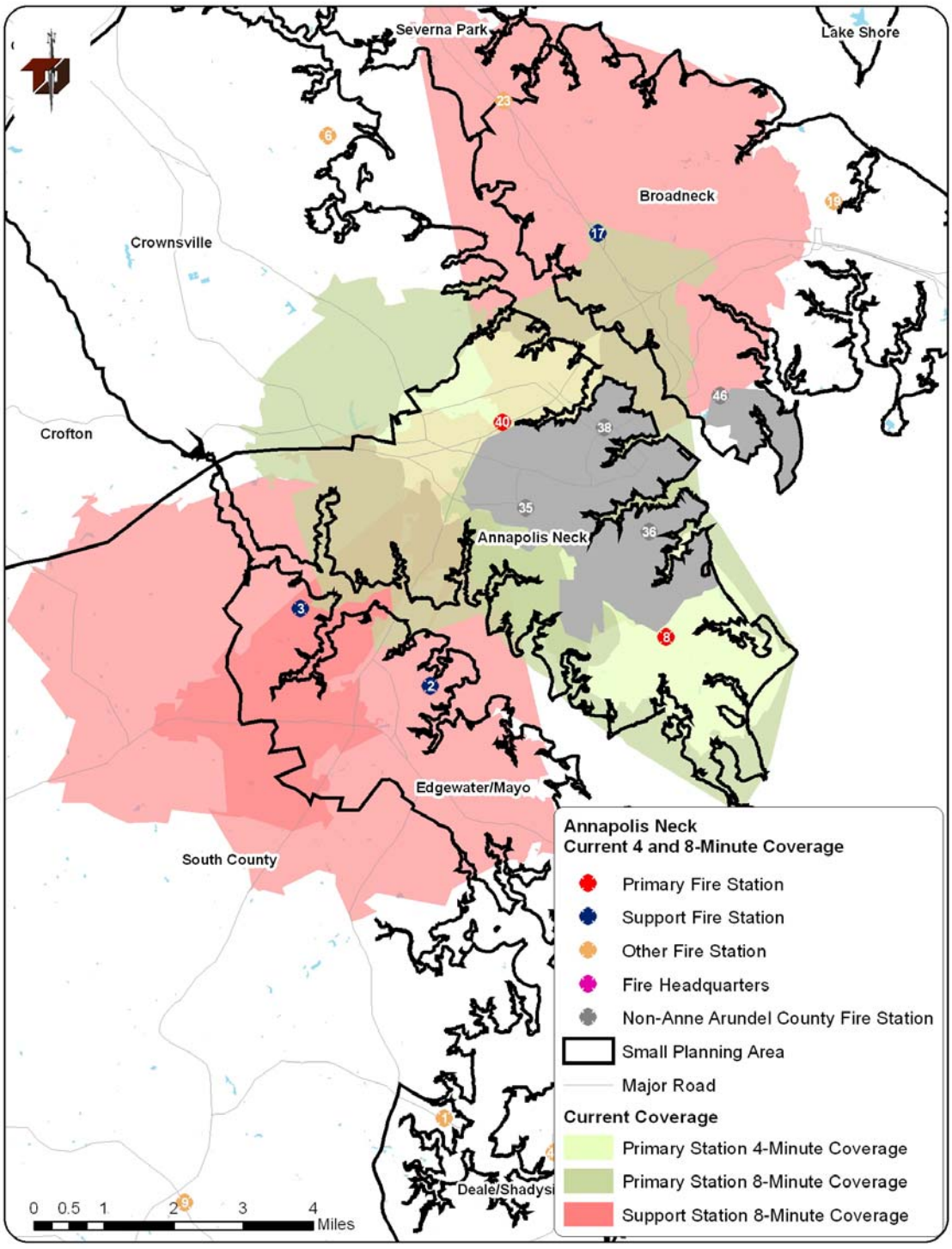
The highest cost (and priority) personnel-wise is $3.14M to add 46 personnel to independently staff seven medic units. The estimated cost to construct 11 new stations is estimated at $16.6M. Nine of these facilities were priced at the lower cost for a modular, residential-type facility. Of the capital projects, only two are considered "very high priority" with an estimated cost of $2.0M, if the lower-cost residential facility concept is adopted.

Review and Further Analysis – Going forward county officials should continue to evaluate the changes and cost implications recommended by this study. The overall set of changes is relatively modest considering the size of the county and its growth. There has been good planning and hard work to deliver fire and medical services by both the career and volunteers. To maintain a safe county, changes are needed to bolster the fire and EMS system to keep up with growth and changes in society.

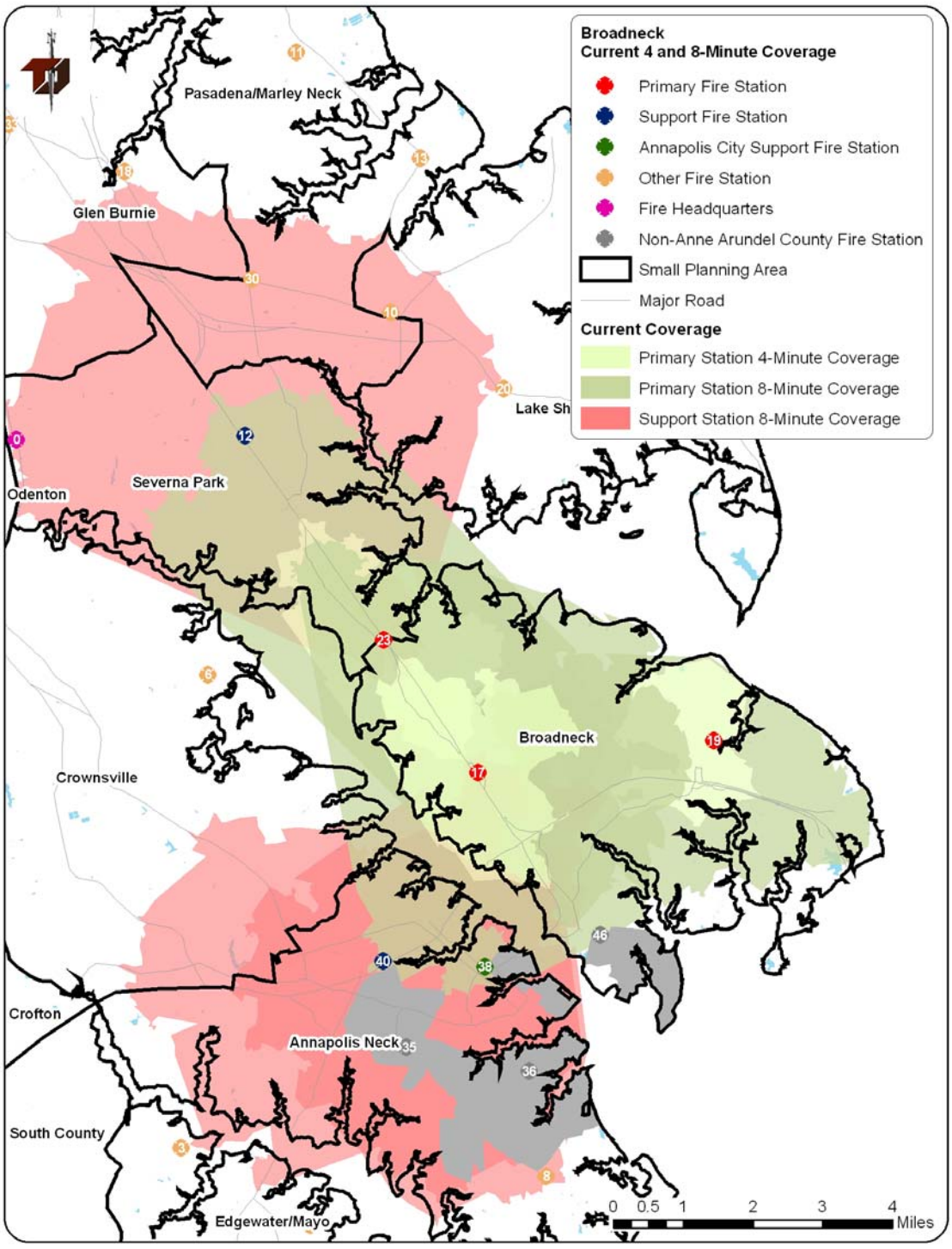
This report attempted to provide a roadmap for coping with the changes to Anne Arundel County in the most efficient manner. We suggest that as changes are made, periodic reviews be conducted to determine what impact, if any, they have, and whether any tweaking is needed to the overall plan.

MAP APPENDIX

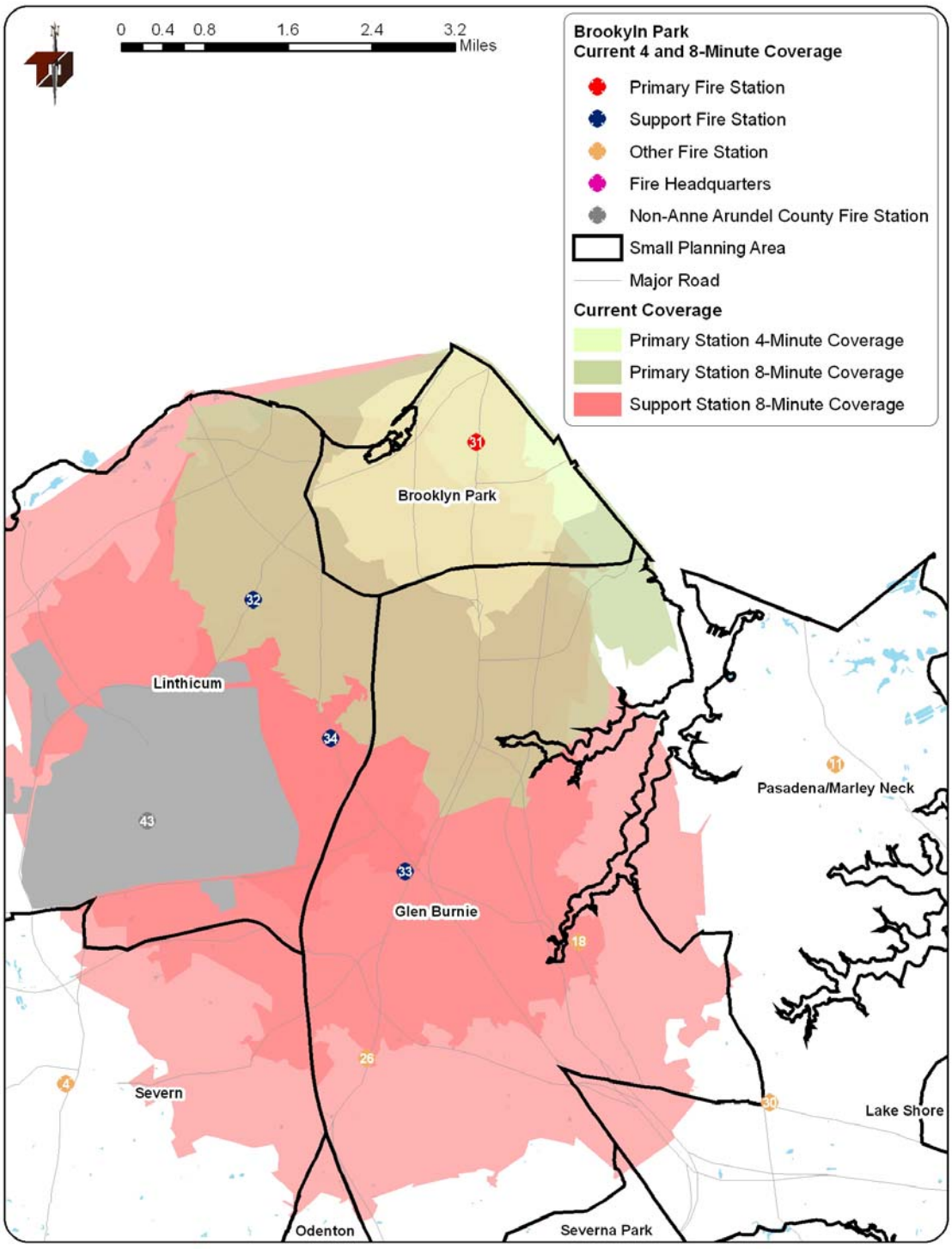
Map 74: Annapolis Neck 4 and 8-Minute Primary Coverage



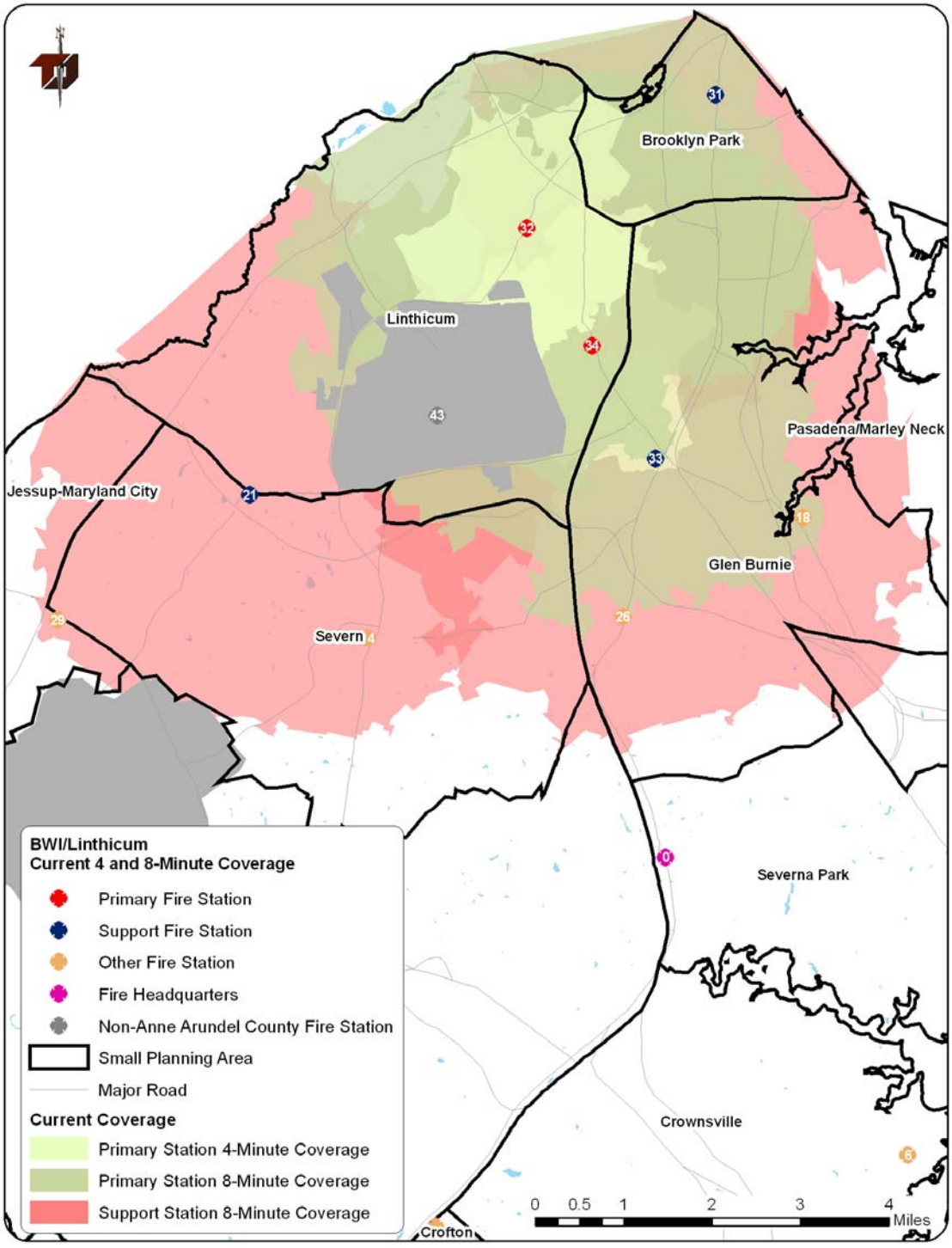
Map 75: Broadneck 4 and 8-Minute Primary Coverage



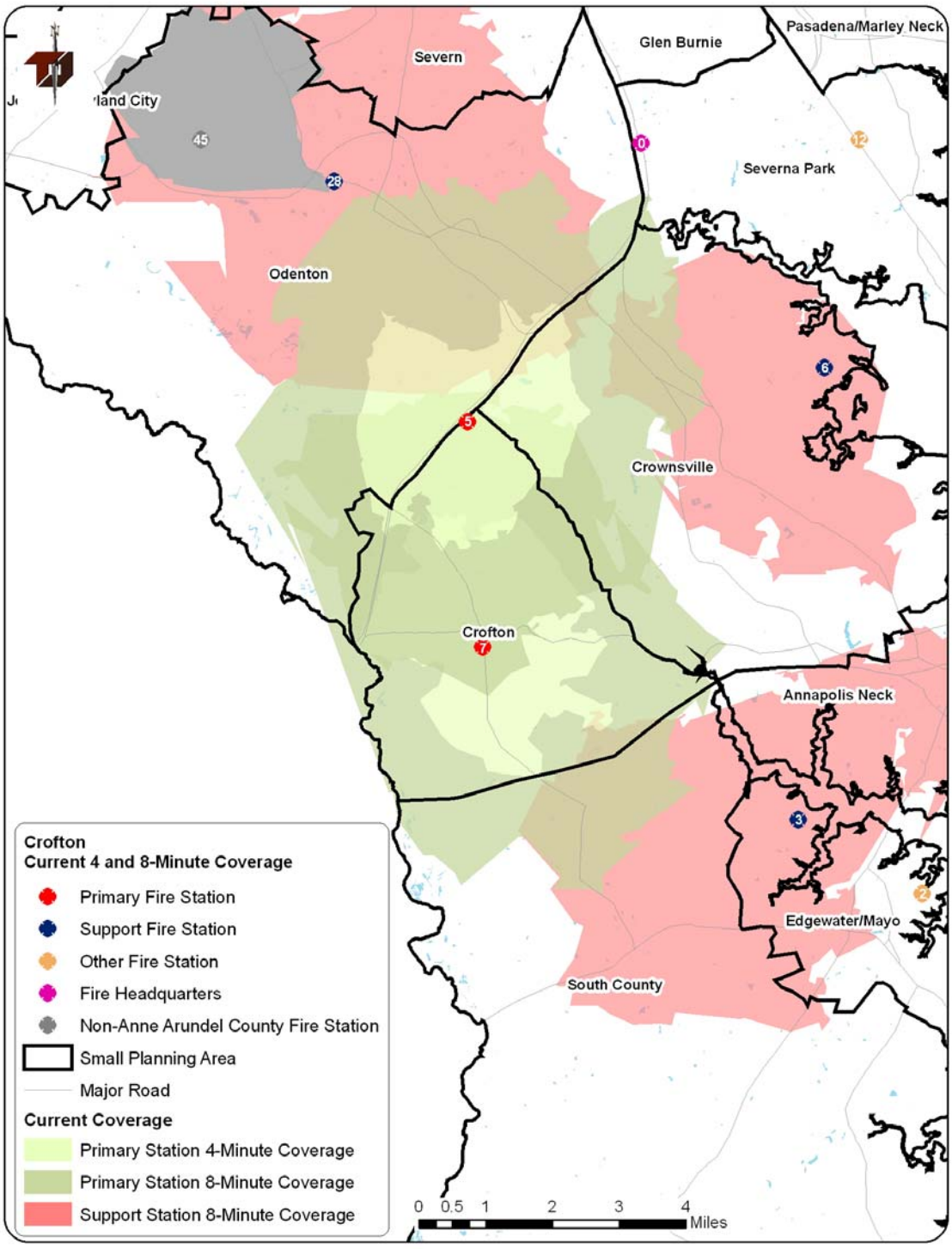
Map 76: Brooklyn Park 4 and 8-Minute Primary Coverage



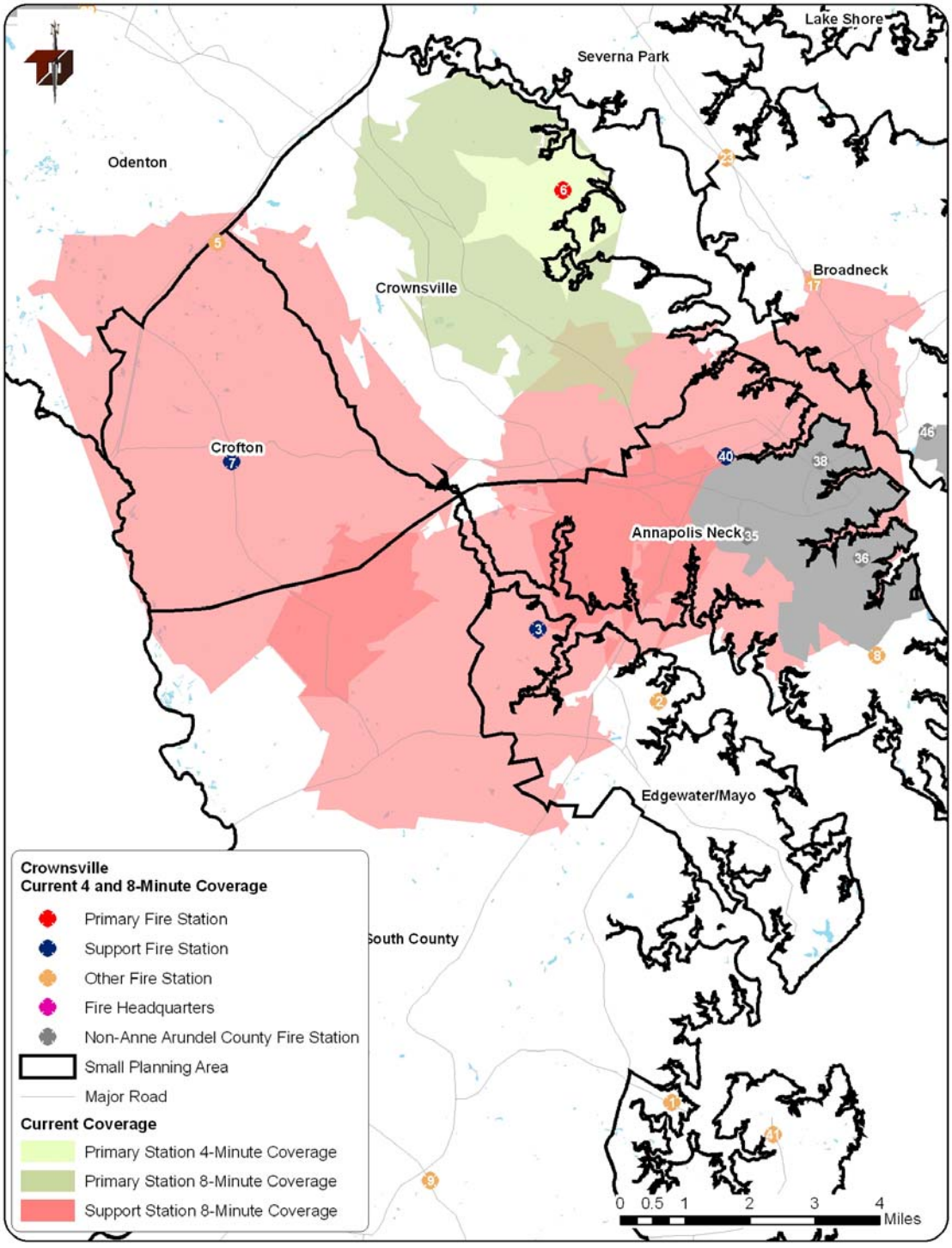
Map 77: BWI-Linthicum 4 and 8-Minute Primary Coverage



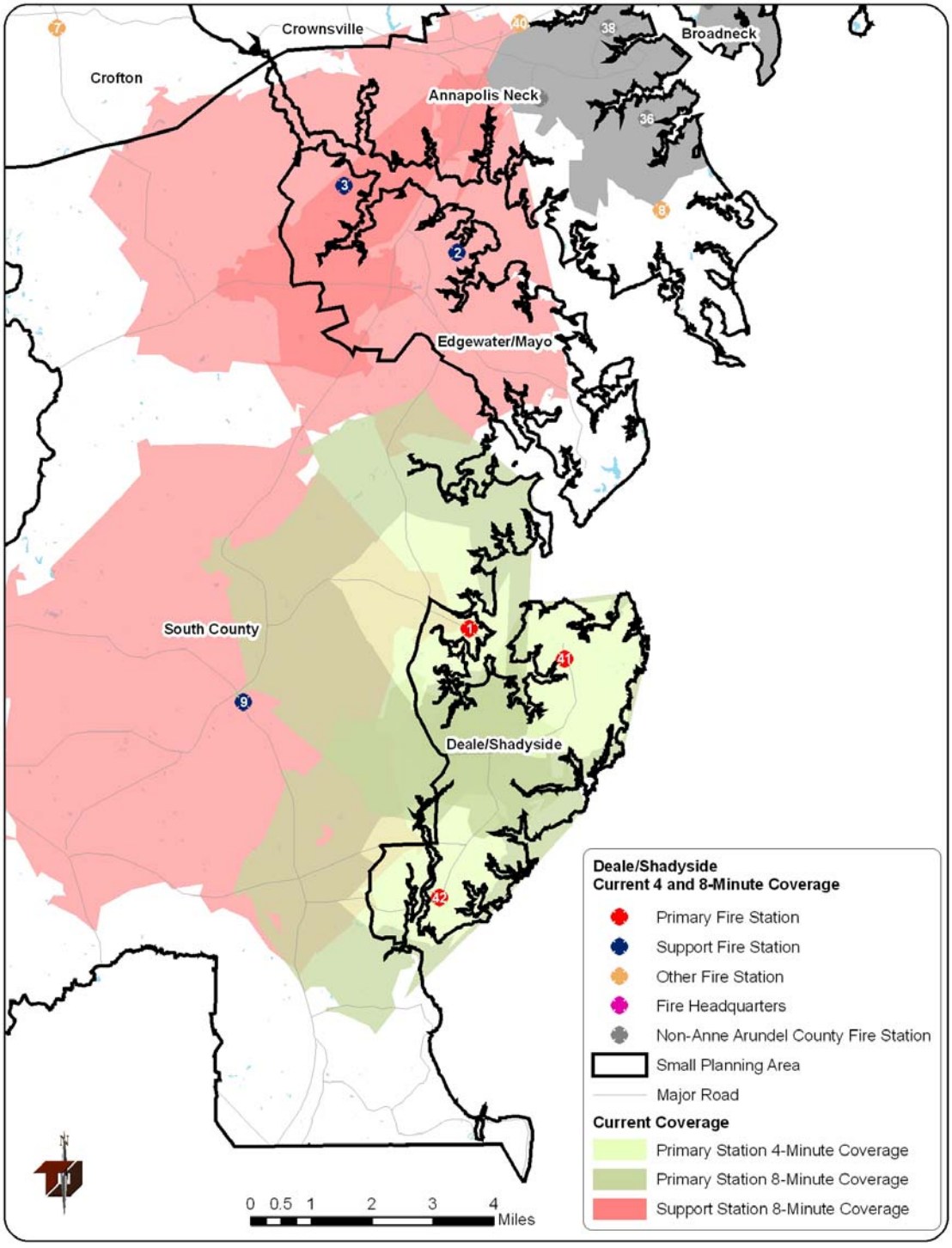
Map 78: Crofton 4 and 8-Minute Primary Coverage



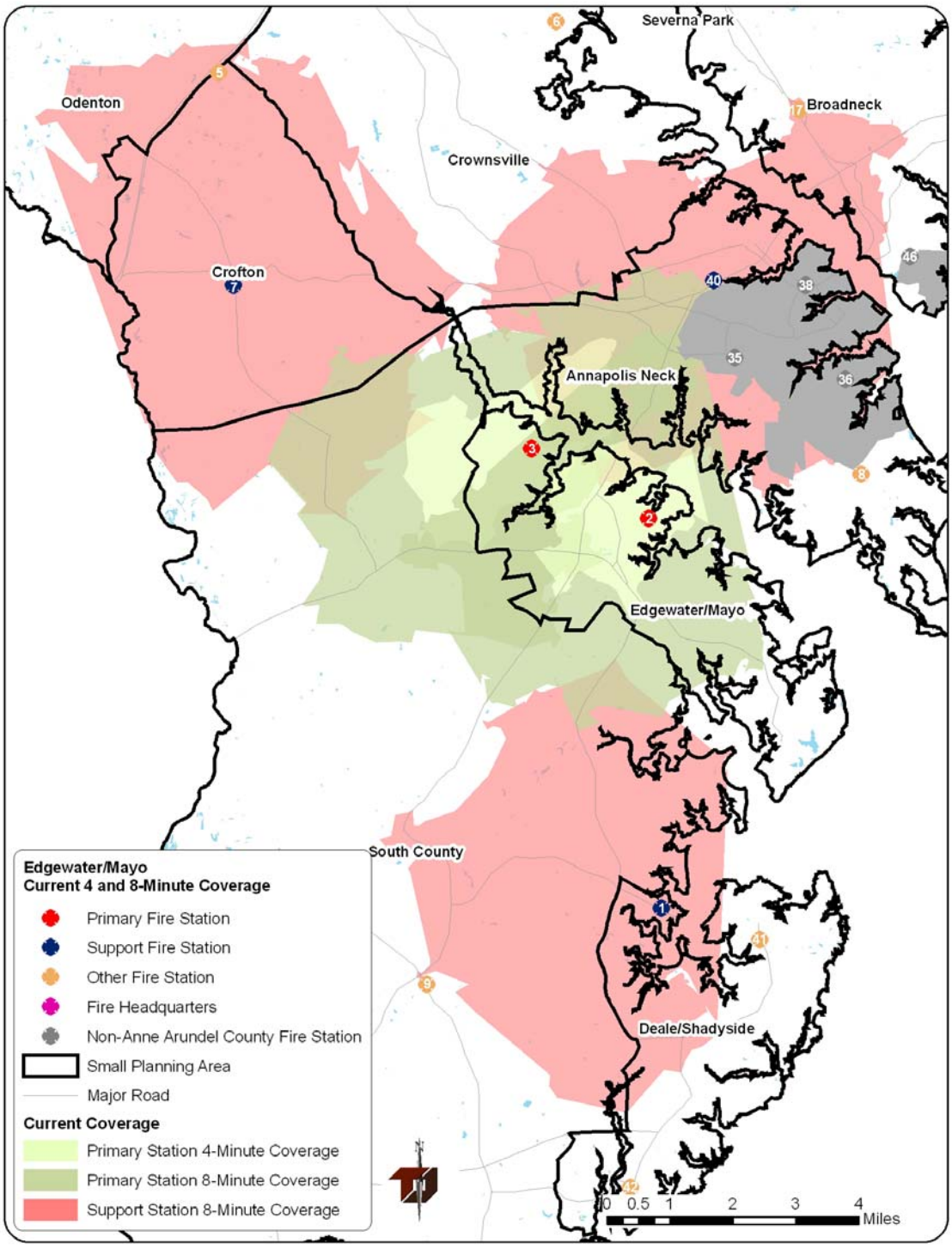
Map 79: Crownsville 4 and 8-Minute Primary Coverage



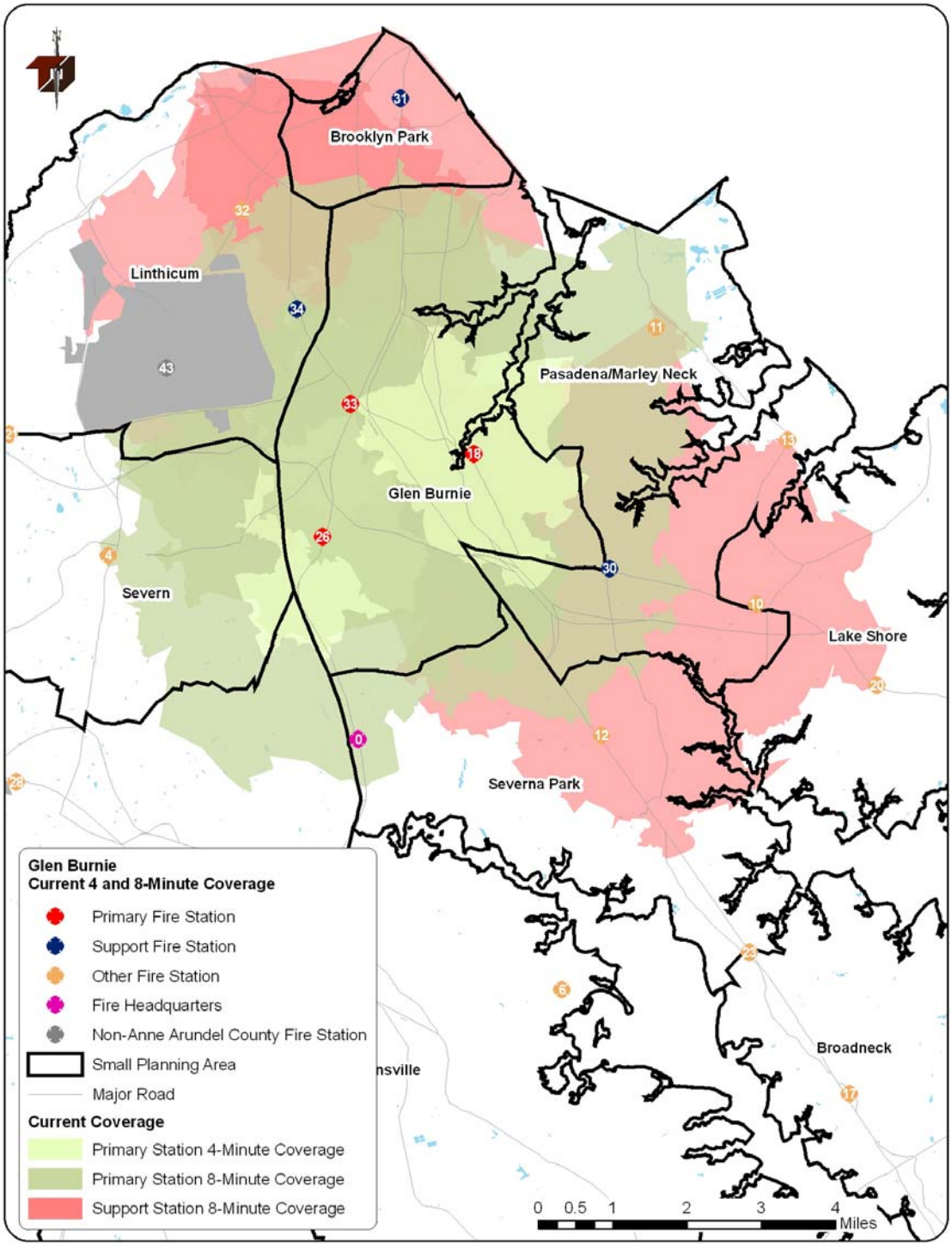
Map 80: Deale-Shadyside 4 and 8-Minute Primary Coverage



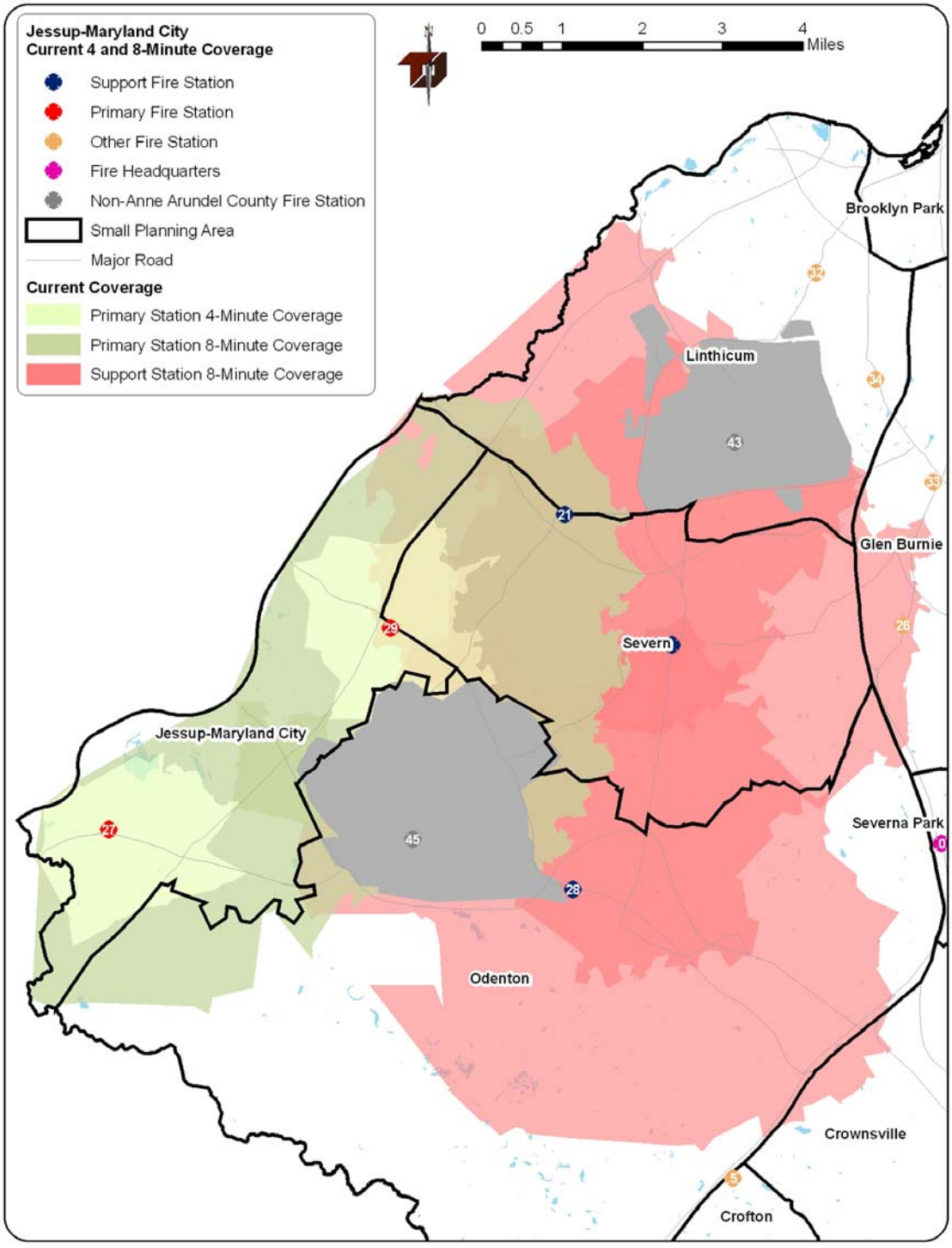
Map 81: Edgewater-Mayo 4 and 8-Minute Primary Coverage



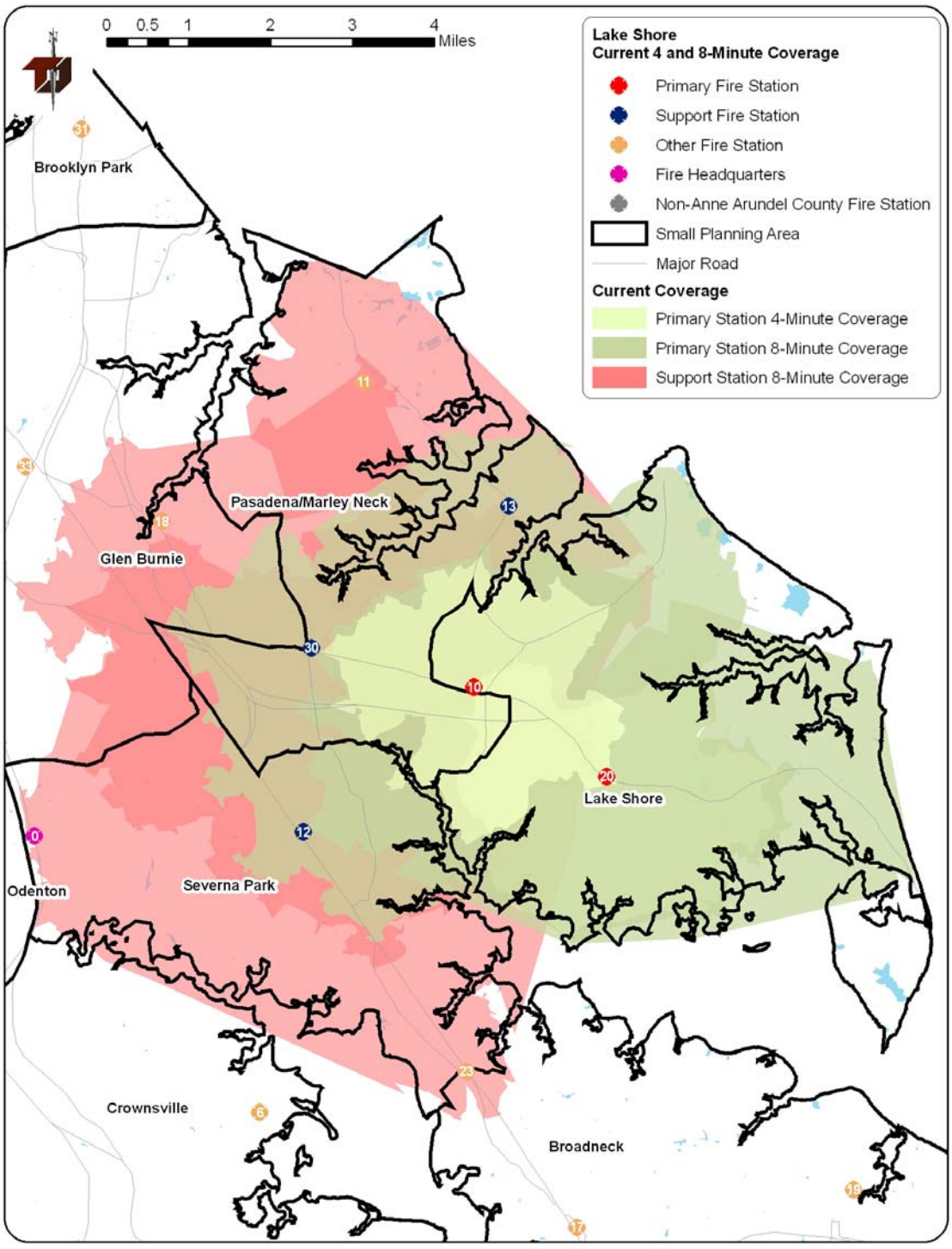
Map 82: Glen Burnie 4 and 8-Minute Primary Coverage



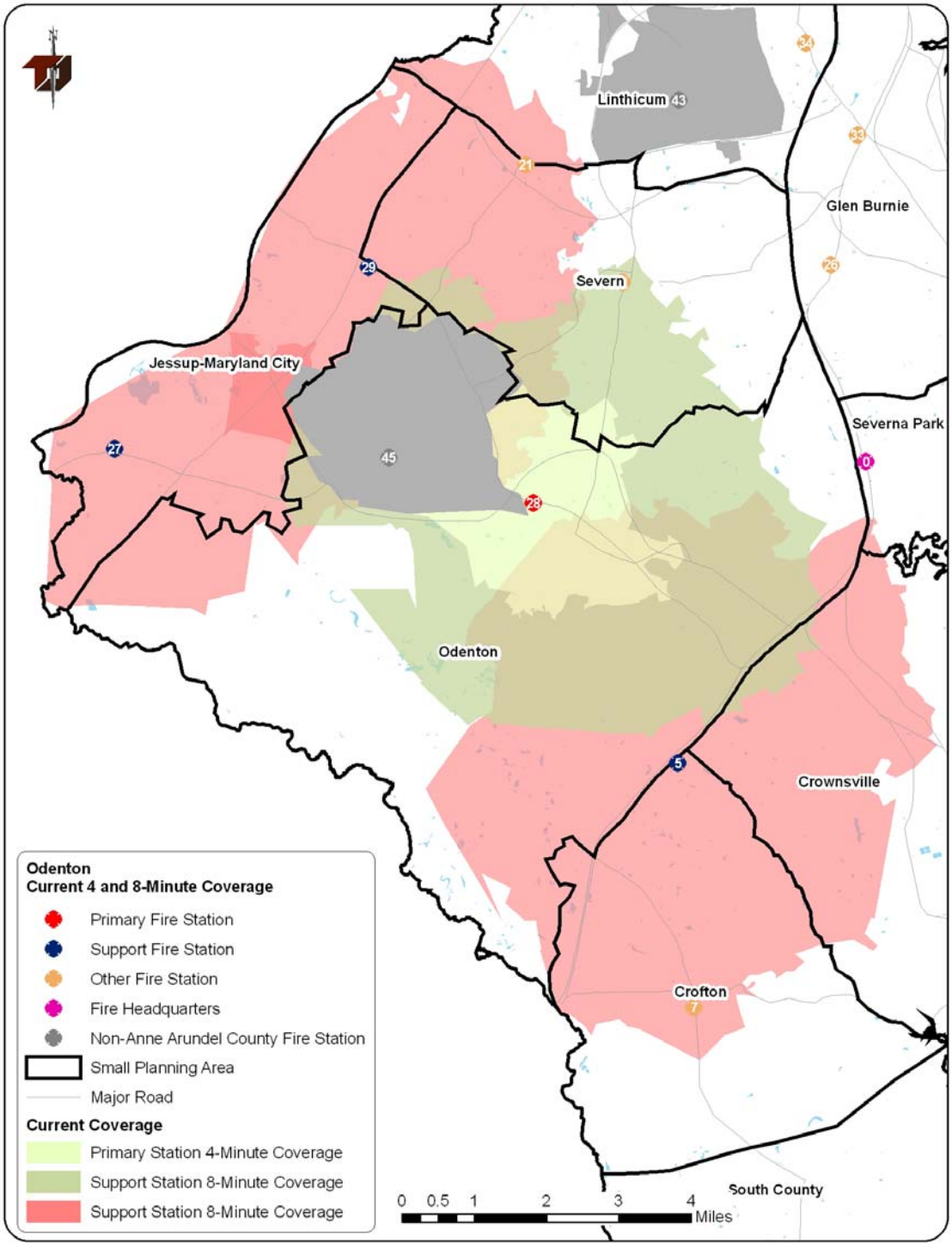
Map 83: Jessup-Maryland City 4 and 8-Minute Primary Coverage



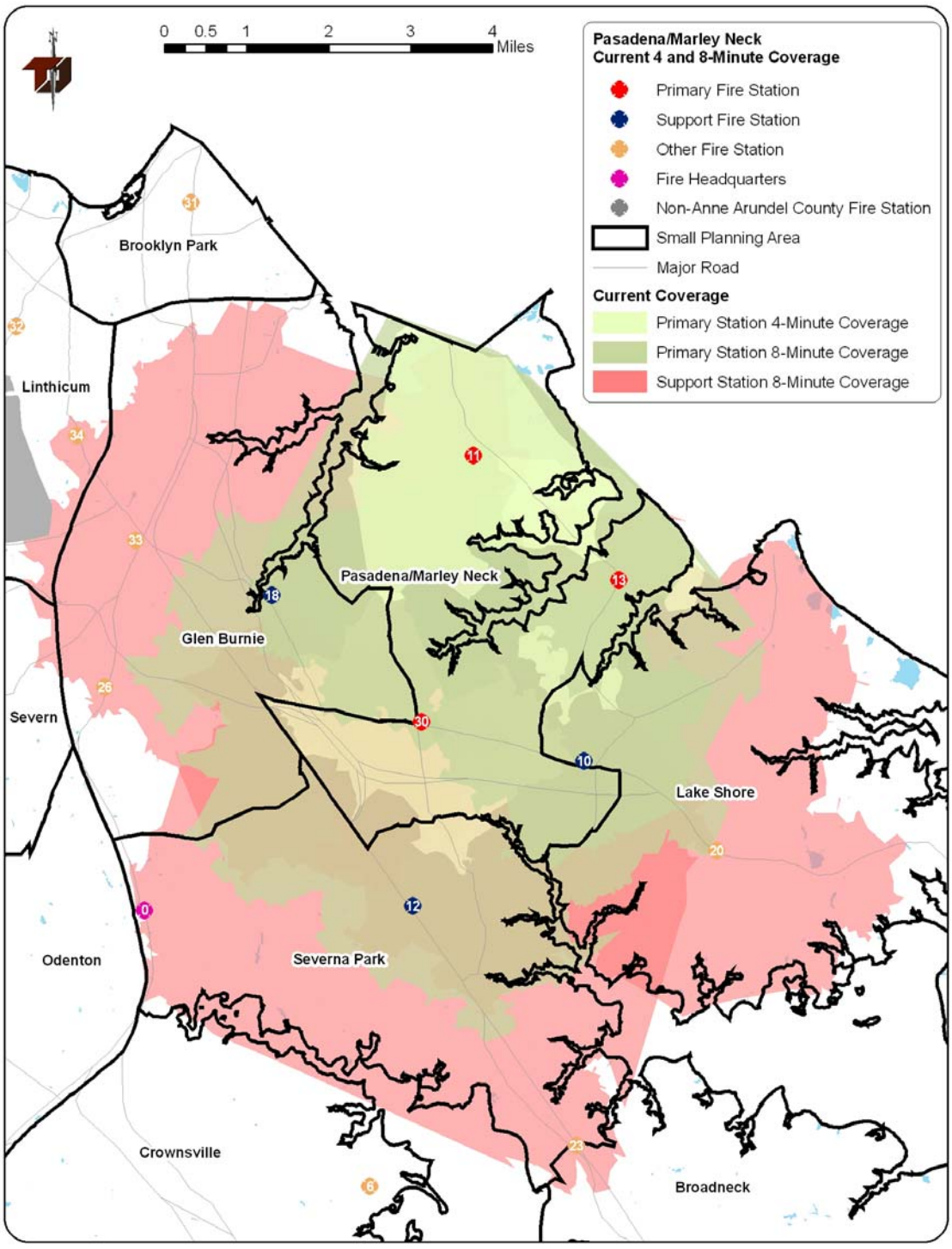
Map 84: Lake Shore 4 and 8-Minute Primary Coverage



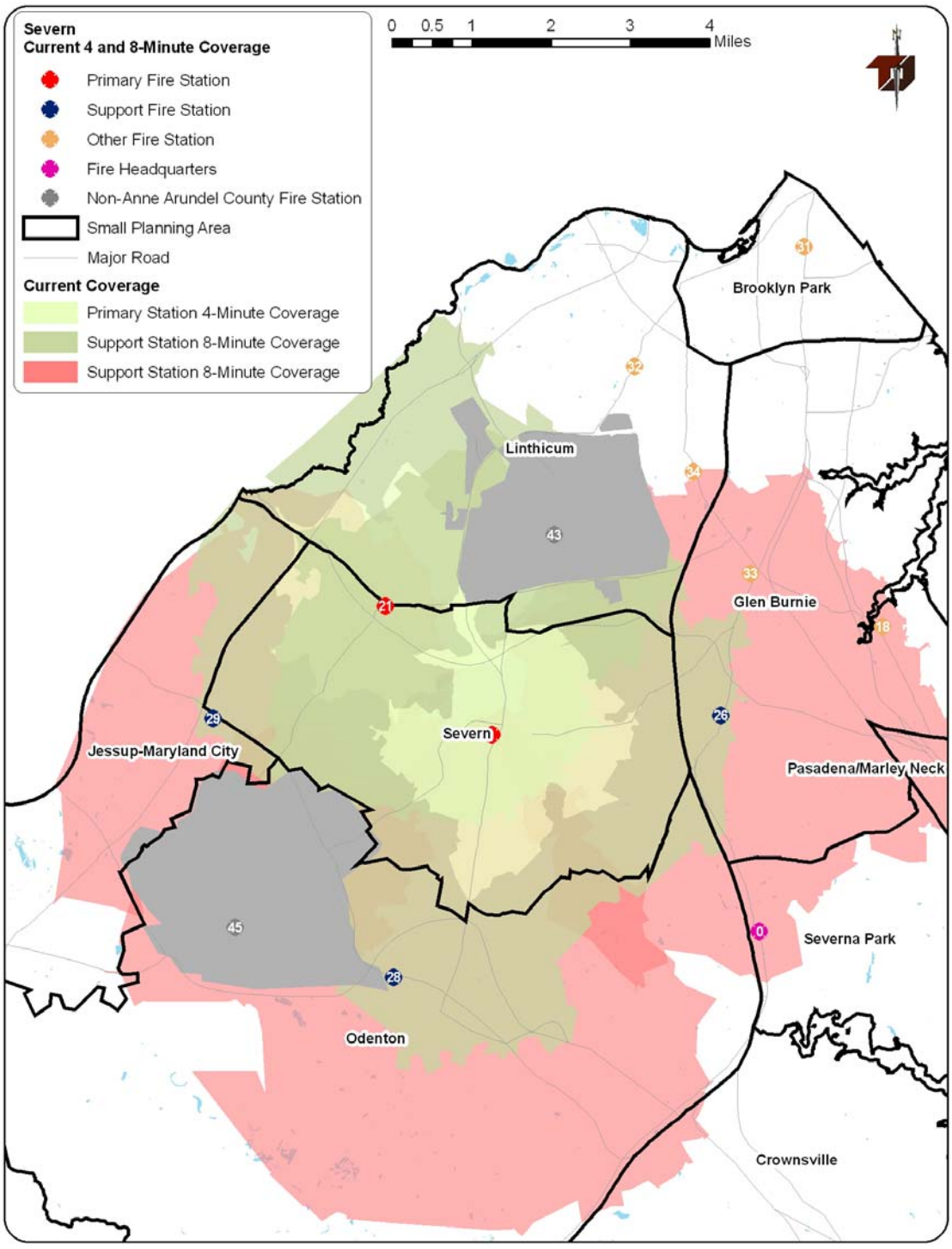
Map 85: Odenton 4 and 8-Minute Primary Coverage



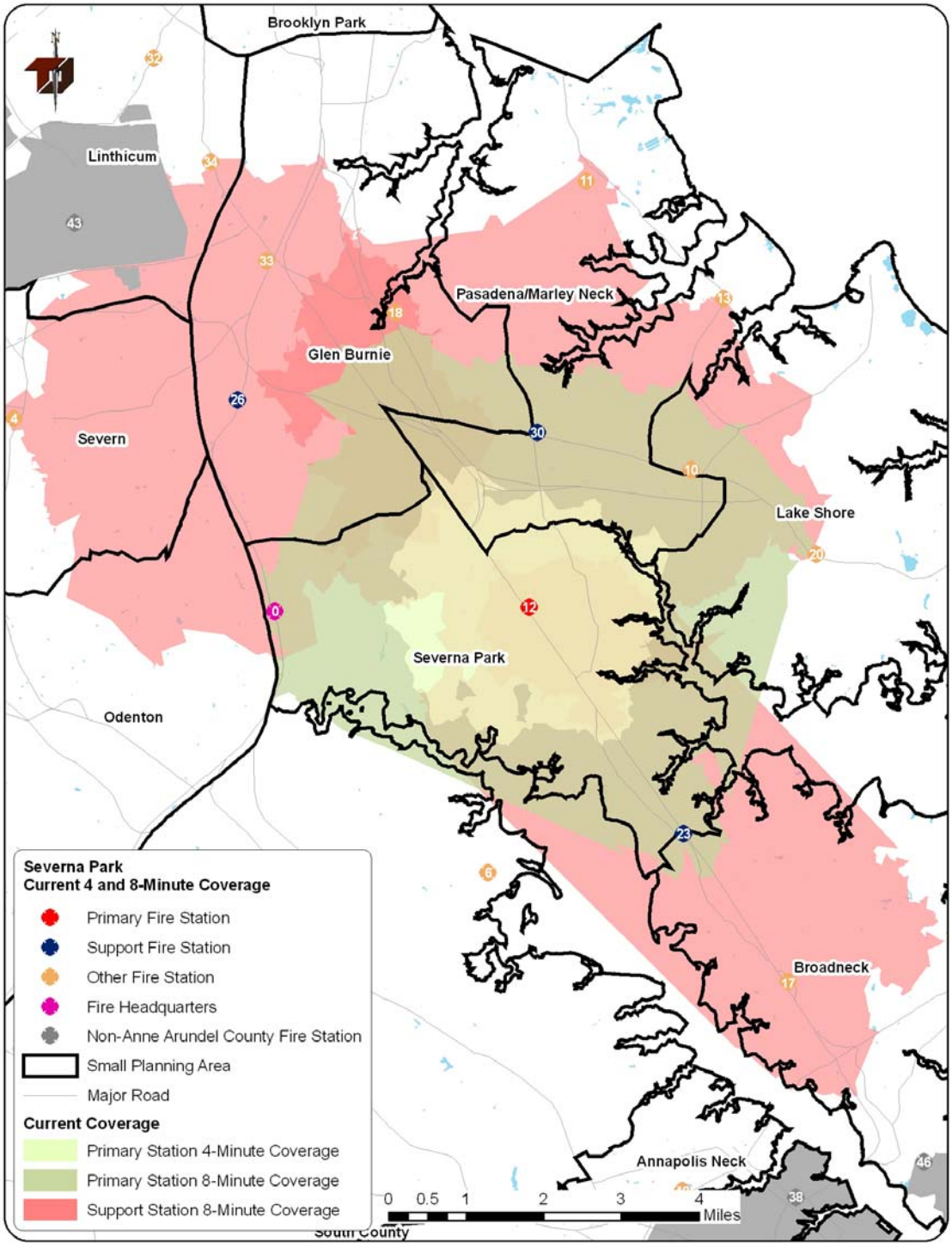
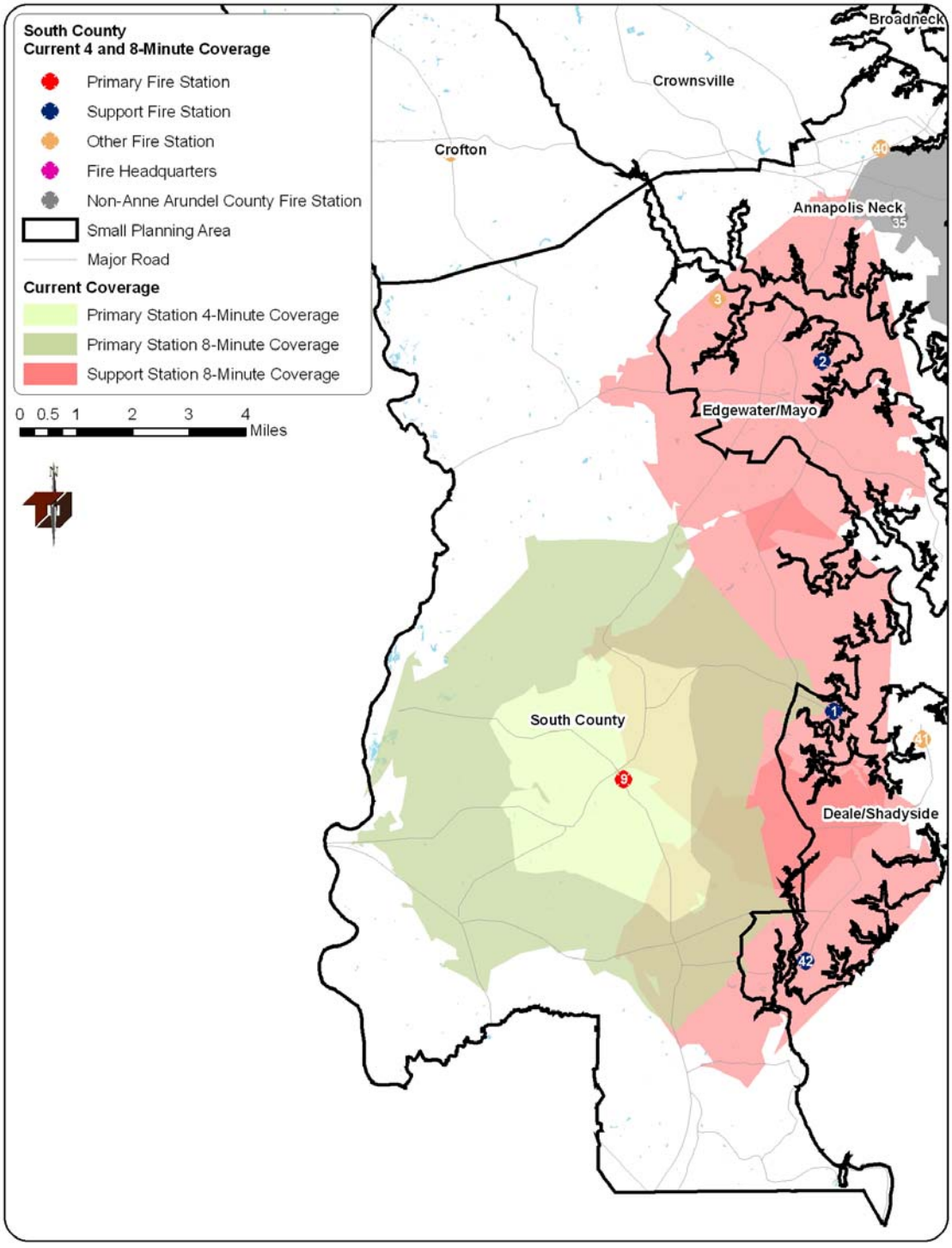
Map 86: Pasadena-Marley Neck 4 and 8-Minute Primary Coverage



Map 87: Severn 4 and 8-Minute Primary Coverage



Map 88: Severna Park 4 and 8-Minute Primary Coverage



Map 89: South County 4 and 8-Minute Primary Coverage